Vol. 47 No. 3 January 1954

Quarterly

of the

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Vol. 47 No. 3 January 1954

Quarterly

The Standard Technical Journal of Fire Protection for More Than Forty Years

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Associated Press Wirephoto

This $500,000 fire in South Bend, Indiana on January 18 was preceded by an explosion in the coal-fired furnace. The janitor had banked the fire at 3:00 A.M. and closed the draft. The explosion at 9:00 A.M. has been attributed to ignition of incompletely burned gases that had accumulated in the flue and furnace. The furnace and part of the chimney were wrecked by the explosion and hot coals scattered about the basement set several fires that spread within nonfirestopped walls to all parts of the three-story brick, wood-joisted building.

A fatal heart attack suffered by a battalion chief was attributed in part to smoke inhalation. He was the only one of a crew attempting to enter the basement who did not wear self-contained breathing apparatus.

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NATIONAL FIRE PROTECTION ASSOCIATION

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The National Fire Protection Association is a non-profit technical and educational organization devoted to the reduction of loss of life and property by fire with a total membership of 15,000. The *Quarterly* is one of the publications regularly provided to members. Other membership publications include a monthly *Fire News, Advance Reports* and *Proceedings* of the Annual Meetings, a *Year Book,* and many leaflets, pamphlets and posters issued throughout the year on fire prevention and control.

Technical committees of the Association develop means to safeguard life and property through the publication of standards covering all phases of fire prevention and protection. Your membership in the Association (annual dues $12.50) affords an opportunity to keep abreast of these developments and, by being a member, you help support this humanitarian activity. Popular educational literature on fire safety is constantly being produced by the NFPA for distribution through its members to the general public.

All members of the Association and the public are invited to NFPA meetings. The following dates are now on the Calendar:

NFPA Calendar

1954

Mar. 15	Closing date for filing 1954 Committee Reports
May 17-21	NFPA Annual Meeting, Hotel Statler, Washington, D. C.
Sept. 20-22	NFPA Regional Meeting, Seattle
Oct. 3-9	Fire Prevention Week

1955

May 16-20	NFPA Annual Meeting, Cincinnati, Ohio
Oct. 9-15	Fire Prevention Week
Nov. 28-30	NFPA Regional Meeting, New Orleans

The closing date for articles submitted for the *Quarterly* is the 15th of the month preceding publication

Proving Spray Sprinkler Efficiency

By Norman J. Thompson, Director*
Factory Mutual Laboratories

Tests to compare the efficiency of automatically operated upright regular sprinklers and upright spray sprinklers for protecting ordinary open joist construction from fires involving "Class A" combustibles have been conducted by the Factory Mutual Laboratories. The results showed that upright spray sprinklers provide substantially better protection to both the contents and the structure.

Spray sprinklers were operated at both the same water discharge rate as the regular sprinklers and at reduced flows. The results showed that less than half as many spray sprinklers opened and that damage to both contents and structure was markedly reduced under both conditions. In all cases the combustible materials were piled to a height of approximately 3 feet below sprinkler deflectors. This clearance is recommended in the NFPA "Standards for the Installation of Sprin-

*Test work and report by J. R. Young, Factory Mutual Laboratories.

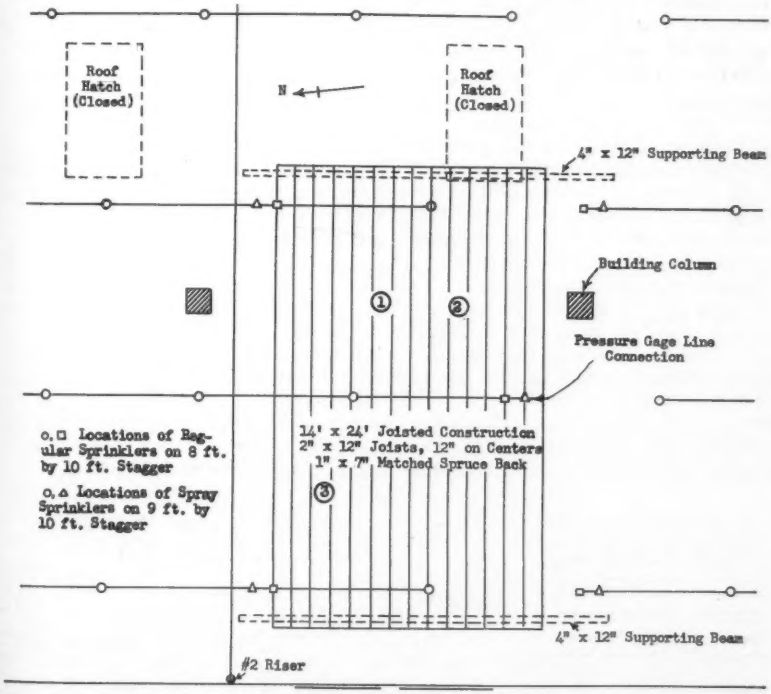
Roof Hatch (Closed)
N
Roof Hatch (Closed)
4" x 12" Supporting Beam
Building Column
1
2
Pressure Gage Line Connection
o, □ Locations of Regular Sprinklers on 8 ft. by 10 ft. Stagger
o, △ Locations of Spray Sprinklers on 9 ft. by 10 ft. Stagger
14' x 24' Joisted Construction
2" x 12" Joists, 12" on Centers
1" x 7" Matched Spruce Back
3
4" x 12" Supporting Beam
#2 Riser

Figure 1. Plan of test area showing location of 14 ft. by 24 ft. open, wood joist ceiling and location of sprinklers. Circled 1 indicates location of crib fire in tests 3 and 4 (spray sprinklers), Circled 2, location of crib fire in tests 1 and 2 (regular sprinklers), and Circled 3, location of crib fire in test 5 (spray sprinklers). Open joist test ceiling was located below the regular plastered ceiling of the test building.

kler Systems" for closely packed piles of cases, bales or cartons.

Test Arrangement

Ceiling

The tests were conducted at the Factory Mutual Laboratories, Norwood, Mass. Special test ceilings were constructed for the research consisting of 2 inch by 12 inch fir joists, one foot on centers, backed by a single layer of 1 inch by 7 inch matched spruce boards, nailed across the joists. Figure 1 shows the details of the test ceilings which were 14 feet by 24 feet in size. The joists were bridged at mid-length with 1 inch by 3 inch spruce strapping. The test ceilings were supported by 4 inch by 12 inch fir beams, on edge, across the underside of the joists at each end and the test ceilings were hung tightly against the permanent smooth plaster ceiling of the test building.

Fire

To provide a reproducible "Class A" fire, wood cribs, constructed mostly of 2 inch by 4 inch fir, nailed 7 inches on centers, were constructed. A typical crib is shown in Figure 2. Each crib weighed approximately 440 pounds, not including the 4 inch by 6 inch supports.

A major portion of each crib promptly became involved in fire by the use of two 3 inch diameter by 6 inch long gasoline saturated cellucotton roll ignitors placed as shown in Figure 2.

Figure 3 shows how a typical crib was elevated on steel pipe framework to place the top of the crib about 3 feet below the sprinkler deflectors. Figure 1 shows the location of the cribs in the various fire tests in relation to the test ceilings and the sprinklers.

Figure 3. A typical wood crib in position under open, wood joisted ceiling. Crib raised on steel pipe framework to about 3 feet below sprinkler deflectors.

Sprinklers

Regular sprinklers were spaced on an 8 foot by 10 foot stagger. Spray sprinklers were placed on a 9 foot by 10 foot stagger. (See Figure 1 for diagram of sprinkler layout.) The elevations of branch lines were adjusted to put sprinkler deflectors 5 inches below the joists on the test ceiling and 7 inches below the adjacent building ceiling. Pipe sizes in branch lines and feeders were in accordance with current Factory Mutual and NFPA rules.

The water supply for sprinklers was through a 750 gallon-per-minute gasoline engine driven pump from a 100,000 gallon reservoir. A Bourdon gauge at the pump enabled the pump operator to follow the opening of sprinklers and to adjust motor speed to hold pressure.

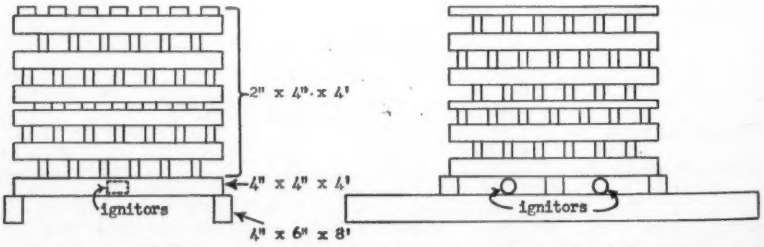

Figure 2. Typical crib used in the fire tests. All 2 inch by 4 inch fir beams nailed 7 inches on center.

Temperature Measurements

Temperatures throughout the test area were followed on a 12 point Brown "Electronik" recorder connected to leads from thermocouples located as shown in Figure 4 and as described in the caption thereof. Thermocouples 1, 2, 4 and 11 (located under the test ceiling) were shifted with each test fire to place thermocouple 2 always over the center of the crib. Thermocouples 1 and 2 were each printed on two recorder points per cycle.

Discussion of Results

Figure 5 gives a summary of the test results. The data in Figure 5 on the

(*Continued on Page 211*)

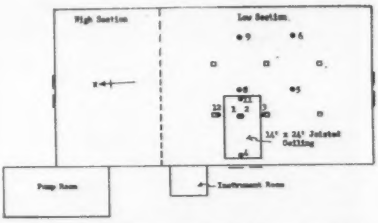

Figure 4. Placement of thermocouples, represented by solid dots. Thermocouples 3, 5, 6, 8, 9 and 12 were located 8 inches below the plaster ceiling of the test building. Thermocouples 2, 4 and 11 were located 2 inches below the test ceiling boards. No. 1 thermocouple was located 2 inches below joist, 6 inches north of No. 2. Squares indicate building columns.

Figure 5
Summary of Comparative Tests of Regular and Spray Sprinklers Under Ordinary Open Joist Construction
Regular Sprinklers on 8 ft. by 10 ft. Stagger
Spray Sprinklers on 9 ft. by 10 ft. Stagger

Item No.	Item	Test 1 Regular Sprinkler	Test 2 Regular Sprinkler	Test 3 Approved Commercial Spray Sprinkler	Test 4 Spray Sprinkler X-5*	Test 5 Spray Sprinkler X-5*
	Water Supply					
1	Pounds-Square-inch	7	7	7	7	5
2	Gallons-per-minute	15	15	15	15	12¾
3	No. Sprinklers Opened	12	8	3	2	5
4	Max. Total Water Flow Gallons-per-minute	180	120	45	30	64
	Crib					
5	Moisture Content 2 x 4's (Percent)	13	16	14	17	5
	Weight loss					
6	Pounds	204	173	9	13	94
7	Percent	48	38	2	3	22
	Ceiling					
	Moisture Content					
8	Boards (Percent)	12	12	12	12	11
9	Joists (Percent)	15	14	15	11	13½
	Damage (Sq. Feet)					
10	Char (⅛" or deeper)	57	25	6	10	26
11	Hole	17	12	0	0	trace
	Thermocouple No. 1					
12	Max. 5 min. Temp. °F.	1470	1450	190	180	880
13	Time Temp. Above 500°F. (Minutes)	21½	21½	3	2½	8

*The "X-5" is a reference sprinkler to which performance of other spray sprinklers is compared by Factory Mutual Laboratories.

NOTE: Distance from sprinkler deflectors to top of crib was 3 feet, 2 inches except for Test No. 2 (3 feet, 6 inches).

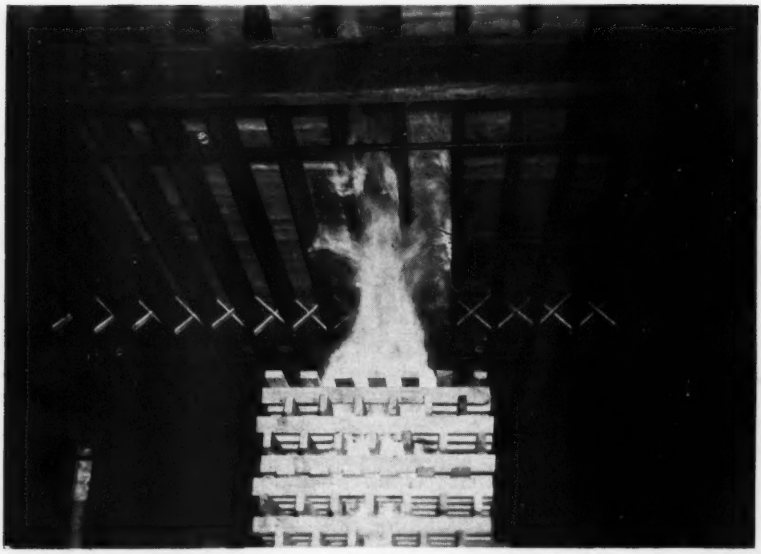

Figure 6. View of degree of fire spread from the crib to the test ceiling 1 minute and 20 seconds after ignition. This picture and Figure 7 were actually taken during Test 3 (prior to sprinkler operation) but are typical of all the tests.

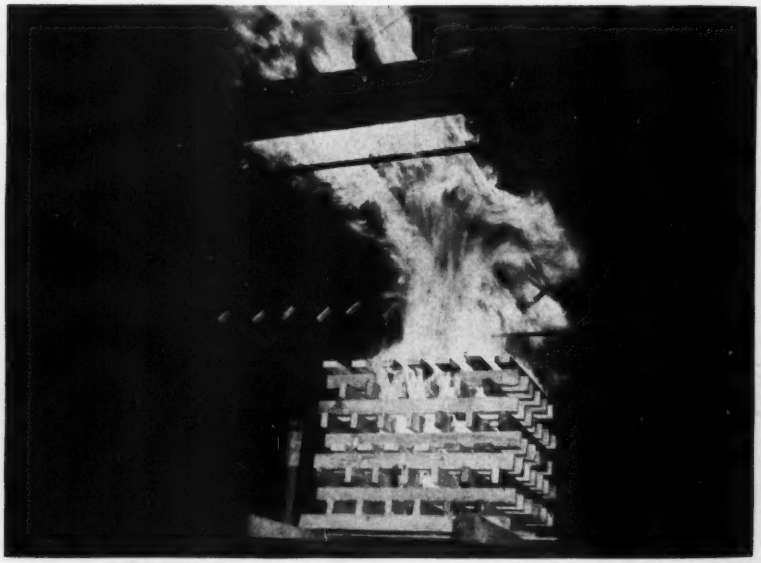

Figure 7. Further spread of fire from the crib to the test ceiling 2 minutes after ignition. (See Figure 6.)

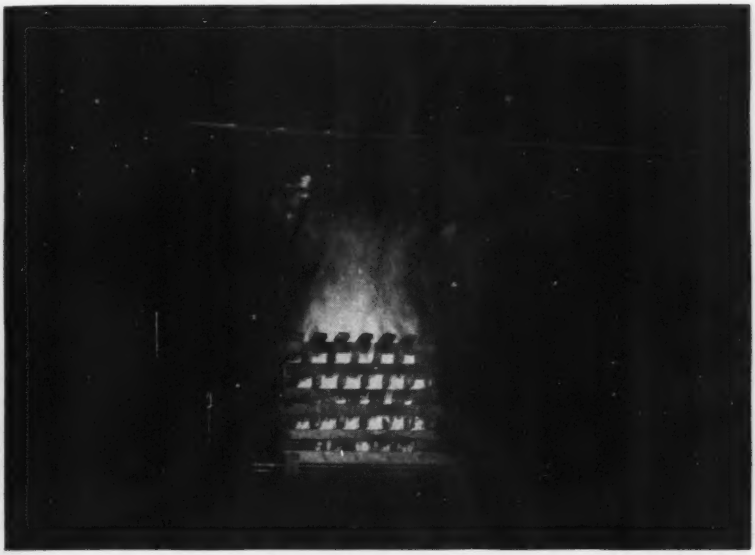

Figure 8. Fire intensity of crib with ceiling involved 5½ minutes after ignition and during the operation of regular sprinklers. (Test No. 1.)

Figure 9. With spray sprinklers operating, 3½ minutes after ignition. (Test No. 3).

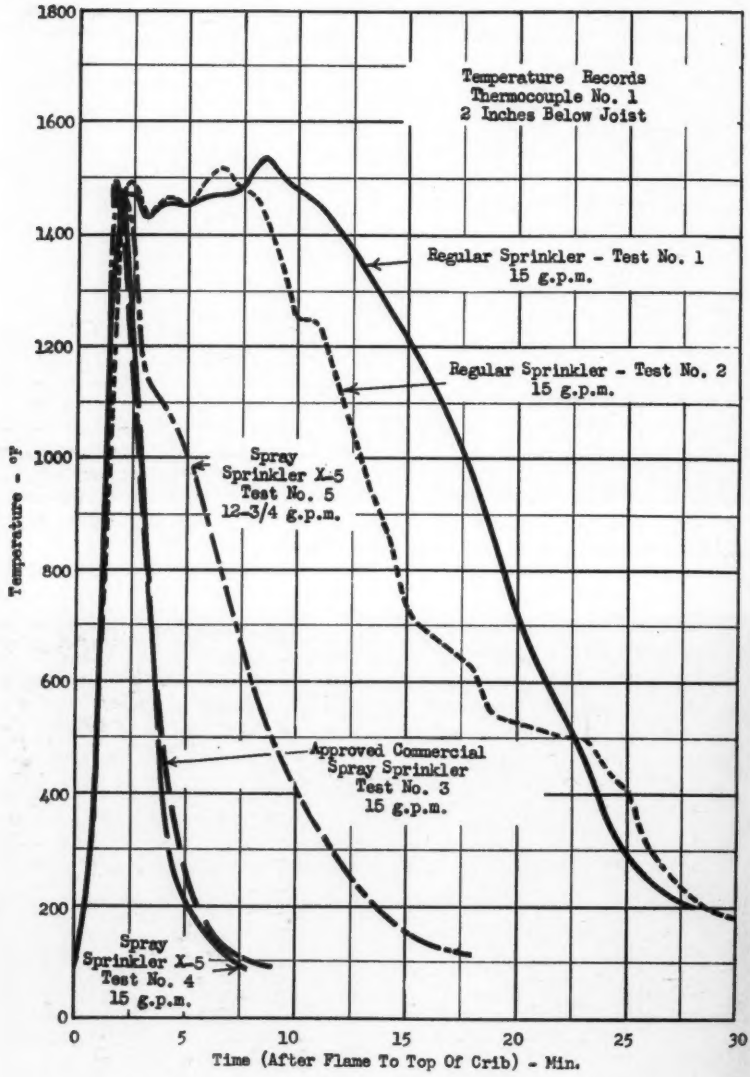

Figure 10.

Chart of the Ceiling Temperature Curves of Tests No. 1-5. This graph shows how the ceiling temperatures were prolonged under the protection of regular sprinklers as compared to the quick reductions effected by the operation of the spray sprinklers.

number of sprinklers which opened (item 3), the weight loss suffered by the wood crib (item 6), the damage to the joisted ceiling (items 10 and 11) and the ceiling temperatures (items 12 and 13) provide sufficient evidence to permit comparison between the protection afforded by spray sprinklers (tests 3, 4 and 5) and that given by regular sprinklers (tests 1 and 2) under these laboratory conditions. This is supplemented by the evidence shown in Figures 8-14.

The total number of sprinklers to open during any one of these duplicate tests depended largely on both the effect of that part of the sprinkler discharge which reached the burning exposure area and the effect of the portion of the discharge which influenced ceiling temperature and the persistence of flaming combustion at the ceiling.

Figures 6 and 7 illustrate the degree to which the ceiling became involved before sprinklers operated.

Figure 8 as opposed to Figure 9 offers visual comparison of crib fire intensities under operating regular sprinklers (Figure 8) as opposed to operating spray sprinklers (Figure 9). The somewhat closer spacing of the regular sprinklers (8 feet by 10 feet) as compared with the 9 feet by 10 feet spacing for spray sprinklers was not a factor affecting initial link operating time. Link sensitivities were approximately equivalent.

The small number of spray sprinklers operating in the tests reflects the rapidity with which control was established over the fires in crib and ceiling. Figure 10 shows the ceiling temperature curves of the various tests.

Comparisons of the fire damages to the test joisted ceilings are clearly shown in Figure 11 (regular sprinkler - test No. 1) as contrasted with Figure 12 (spray sprinkler - test No. 3), and Figure 13 (regular sprinkler - test No. 2) as contrasted with Figure 14 (spray sprinkler - test No. 4). These comparisons substantiate the more effective control by spray sprinklers as compared to regular sprinklers.

Regular sprinklers, operating at the discharge pressure and sprinkler-to-haz-

Figure 11. The 17 sq. ft. of holes in the wood test ceiling occurred during Test No. 1 where regular sprinklers were used.

Figure 12. With spray sprinklers, the ceiling was protected in Test No. 3 with only 6 sq. ft. of char, 1/8th inch or deeper.

Figure 13. In Test No. 2 using regular sprinklers, the maximum five minute temperature reached by Thermocouple No. 1 was 1450°F. The test ceiling burned through over a 12 sq. ft. area.

Figure 14. In Test No. 4 using spray sprinklers, the maximum five minute temperature reached by Thermocouple No. 1 was only 180°. The test ceiling did not burn through.

ard distance of these tests, were ineffective to the point that the reduction in crib fire intensity which ultimately occurred was credited largely to the depletion of combustible crib material. Water thrown directly at the ceiling by the regular sprinklers provided direct protection to only a small proportion of the total ceiling area; water was thrown out and down in insufficient quantity and at too narrow an angle to protect the crib.

Conclusion

These comparative tests of upright spray sprinklers and upright regular sprinklers under joisted construction, with test fires about three feet below sprinklers, showed that substantially better protection was provided by the spray sprinklers.

In comparison with the performance of the regular sprinklers, even at a somewhat increased sprinkler spacing, less than half as many spray sprinklers opened, damage to ceiling and crib was markedly reduced, and ceiling temperatures were lowered.

The considerable proportion of the discharge from a regular sprinkler which impinges directly on the ceiling is effective over but a minor part of the total protection area allotted per sprinkler and is lost to the area remaining to be protected. The spray sprinkler, which throws insignificant amounts above the plane of its deflector, conserves nearly total output for general coverage.

Direct wetting is not necessary to wood ceiling protection if ceiling temperatures can be brought below the kindling point.

Note

Spray sprinklers show to particular advantage over regular sprinklers when good distribution at the higher levels is needed. The difference in performance when the fire is at the floor level, is directly under regular sprinklers, or is more shielded, will not be as pronounced as the difference shown under these test conditions.

Fire Protection Developments in 1953

By Percy Bugbee, General Manager,
National Fire Protection Association

Fire caused 12,360 deaths in the United States and Canada during 1953, according to estimates prepared by the NFPA Department of Fire Record. Estimated deaths in 1952 were 12,535. These estimates are based on U. S. Census figures and official Canadian statistics of prior years with adjustment for current trends as reflected in NFPA fire records. While the reduction in loss of life seems slight, it is definitely a reversal of the trend of the past several years and is therefore, to that degree, encouraging.

We have become increasingly concerned over the large number of deaths and injuries in fires caused by oil stoves, particularly since these deaths and injuries involve a high percentage of children. All of the indications seem to show that such fires have been increasing in recent years and oil stoves are now the primary cause of deaths from fire in dwellings. We are currently undertaking special studies of this situation in cooperation with fire chiefs and hope that this investigation will result in a determination of causes which can be eliminated through design, enforcement or education.

The adoption of a standard reporting form for fire casualties is proving very helpful in securing more adequate fire casualty statistics.

Fire Losses

Preliminary estimates indicate that fires caused $1,072,500,000 property damage in the United States in 1953, including $912,500,000 damage to buildings and contents and $160,000,000 loss in aircraft, motor vehicles, forest and other fires not involving buildings. Corresponding 1952 figures were $942,650,000 of which $793,500,000 were in buildings and contents and $149,150,000 in other fires. The General Motors Corporation fire at Livonia, Mich. in August accounted for approximately half the increase in building and contents loss last year. If the trend in Canadian losses is similar to that in the United States, total losses in the two countries for last year will be approximately $1,160,000,000.

The General Motors plant fire at Livonia, Mich. on August 12[1] was the largest industrial fire loss on record and without much doubt has been the most discussed fire that has occurred in many years. The general awakening of industrial management to the potentially disastrous results of fire on production was the one beneficial effect of this disastrous fire. During and since World War II we have witnessed the development of extremely large area buildings for industrial production and for warehousing. There have been numerous large loss fires in such buildings, all of which have been recorded but none of these up to the time of the General Motors fire has been of such a magnitude as to halt this trend.

There were several severe loss of life fires in 1953. On March 29, 32 patients and a nurse were trapped and killed by fire at a nursing home near Largo, Florida.[2] Principal factors in this case were the highly combustible interior finish, insufficient personnel, and no automatic protection for a property remote from adequate public protection.

Thirty-five persons were killed and 38 injured at the Haber Corporation fire in Chicago on April 16.[3] The casualties in this case were due primarily to inadequate exit facilities.

---

[1]See October 1953 *Quarterly*, pages 105-120, reprinted in pamphlet form, NFPA Q47-2, 25 cents.

[2]See April 1953 *Quarterly*, pages 293-300, reprinted in pamphlet form, NFPA Q46-13, 35 cents.

[3]See July 1953 *Quarterly*, pages 61-64.

Again in Chicago on September 7, 18 persons were burned to death on the upper floors of a crowded four-story tenement building. In Boston on October 16, 37 Navy and civilian personnel were killed and 40 injured on an aircraft carrier undergoing repairs when a flash fire developed from ignition of flammable hydraulic fluid.

There were forty-eight fires in 1953 each with losses of one million dollars or more as compared to forty-four such fires in 1952. Government property suffered heavily. An army warehouse in Whittier, Alaska, burned on June 17 with loss estimated at $10,000,000; a government warehouse in Philadelphia burned on June 22, with loss estimated at $1,715,000; and a Royal Canadian Air Force warehouse burned in Calgary on December 24 with a loss estimated at $675,000.

Last year also recorded some serious aircraft fires. A U. S. Air Force plane crashed and burned following take-off from a base near Tokyo, Japan which cost 129 lives, the worst air disaster in history. Forty-four servicemen were killed in a U. S. Marine Corps crash fire in Florida and thirty-five persons died in a crash fire involving a chartered, nonscheduled aircraft in California. There were sixteen aircraft fires in 1953 with loss exceeding one million dollars each, of which 12 were military. U. S. scheduled domestic air carriers enjoyed one of the best years in history; only two major fire incidents occurred in 1953 affecting this group, both cases involving Constellation aircraft burning after crash landings at airports.

Fire Departments

While the trend to higher wages and shorter work hours for paid firemen in the United States continued throughout 1953, the developments in this direction were not nearly as marked as they were in the previous two or three years. As long as the federal and state governments absorb the major share of tax monies, our cities will inevitably be pinched for operating funds, and fire departments as well as all other municipal departments are faced with budgetary problems.

With shorter working hours for fire fighters and limited municipal revenues, several cities are planning reorganization of their fire departments to provide fewer, better manned fire companies, and new station locations. This financial problem also is causing progressive fire departments to intensify their fire prevention activities with the realization that it is impossible to maintain as many fire companies as might be desirable to meet every adverse situation. With fire companies radio equipped, more and more departments are scheduling regular "on the air" inspection tours for all companies.

Interest in the use of techniques of water spray and water fog for fire fighting continued to accelerate throughout the past year to the point where the great majority of U. S. fire departments are fighting their dwelling house fires and many other everyday varieties of fires with 1½ inch lines, less water damage, and more efficiency. Procedures for training firemen continue to improve both in the amount of training offered and in the efficiency of the training programs. There is a strong and very desirable trend towards better equipment, better fire fighting methods, and an acceptance of new ideas in fire fighting which is very gratifying. Unfortunately, some fire departments still lag in making effective use of improved equipment because of failure to supplant outmoded equipment and techniques (See "Modern Fire Department Equipment," page 218 of this *Quarterly*). There is practically none of the thousands of fire departments throughout the United States and Canada today that cannot turn to some dependable nearby source for a sound training program.

The desirable expansion of fire protection into the rural areas through the organization of rural fire protection districts in the United States and Canada continued throughout 1953. In a number of the states with large farm and rural areas, state legislation has been adopted which provides for the organization of rural fire

protection districts with provisions for taxing to provide fire equipment or for contracting with organized fire departments in cities and towns for furnishing services to the rural areas.

Notable new contributions to the literature of fire fighting were Lloyd Layman's "Fire Fighting Tactics"* and the manual on "Operating Fire Department Pumpers"†, both issued by NFPA in 1953.

The campaign undertaken by the International Association of Fire Chiefs to reduce the numbers of fire deaths to children through home inspections by firemen made substantial progress last year and many millions of homes, especially on the West Coast, received the benefit of such inspections. It is becoming harder for fire departments who still are not carrying out a home inspection program to justify their inaction in view of the public acceptance of and desire for this service. We look forward to the day when this practice will become universal in all fire departments because such inspections can be undertaken, in practically every case, whether the community is large or small, without any additional expense to the taxpayer. Such a program can substantially reduce loss of life and the number of dwelling fires and greatly increase the prestige of the local fire department.

Civil Defense

A number of special developments during the past year should be mentioned. At the start of the year the East River Project turned over to the appropriate government authorities a comprehensive report on the ability of the United States to defend itself against enemy attack. The control of fire under such a situation is of major importance and measures to control fire received an adequate share of attention in this document. The report has been well received in high quarters and is, in our opinion, a major contribution to the safety of the country.

Again, as in the previous year, civil defense activities were spotty. In some sections much time and effort have been devoted to civil defense, and in others very little. The American public as a whole has not been sufficiently aroused to the danger to demand an adequate and sound program of civil defense even in the most obvious target areas of the country.

In the early fall the Federal Civil Defense Administration published a list in which it named 70 United States cities as critical target areas and 123 others which might be considered as targets for enemy attack with A-bombs or other modern weapons. As might be expected, this list includes practically all of the important metropolitan centers. It is official and public recognition of the fact that these target communities must seriously get down to the business of deciding what, if anything, they are going to do about the threat of enemy attack. Recent A-bomb tests in Nevada have demonstrated very clearly that one of the vital things that any community must do to reduce the hazard is the removal throughout the community of all sorts of unnecessary combustible materials. Some of these tests show that in a 10 square mile area not demolished by the blast but within what is called the primary fire area, we could have more than 100,000 fires starting from such materials as discarded papers, dead grass, wooden fences, and the like. In essence, these tests have shown with crystal clarity that the kind of clean-up that is carried out during such periods as Fire Prevention Week and spring Clean-up Week is essential.

Insulation Board

A constructive step was taken in 1953 towards the reduction of the life hazard from combustible interior finish materials, which have been a serious factor in fatal fires in hotels, hospitals, nursing homes, bowling alleys and other occupancies, when the members of the Insulation Board

*Available from NFPA Publications Service Department, $3.75 per copy.

†Available from NFPA Publications Service Department, cloth bound, $3.50, paper bound, $2.50 per copy.

Institute agreed to provide a flame retardant surface coating for all the combustible board they manufacture.

Nursing Homes

Great interest was aroused throughout the country in the problem of more adequate fire protection for nursing homes because of the two serious loss of life fires, one late in 1952 in Missouri, and the one in Florida previously referred to in this article. Fire marshals and other state and local officials throughout the country concerned themselves with this difficult problem and much has been accomplished in making such occupancies safer.

Fireworks Legislation

Adequate fireworks control is now in effect through legislation in 27 of the states. Connecticut adopted the model fireworks law this past year after a prolonged and bitter struggle. A federal bill to prohibit the sending of fireworks through Interstate Commerce into states that have good fireworks legislation was introduced by Representative Church of Illinois and received considerable attention. It appears likely that this bill may be adopted in 1954.

Farm Fire Safety

An encouraging development has been the recognition in a number of rural states of the seriousness of the fire losses on farm properties and a number of states, notably Ohio, have gone into a rural fire prevention program which has indications of being very successful. Inspections of farm properties for fire hazards are just as logical and just as effective as inspections of industrial, mercantile and dwellings in cities. The procedures for making such inspections perhaps require greater planning but wherever they have been tried they have proven of substantial value.

Technical Developments

Among the important technical developments in fire waste control that have taken place in 1953, one that has perhaps attracted the most attention among fire protection authorities has been the adoption of the new Standards for Spray Sprinklers by the NFPA. Some go so far as to say that the use of spray sprinklers will revolutionize the fire protection of many major properties.[1]

As the National Electrical Code is one of the most widely adopted standards in the country, and as this Code affects in one way or another practically every person and every building throughout the country, a new edition of the Code is a major event in fire protection. The 1953 edition of the National Electrical Code is already in very wide use.[2]

Public Law 88, known as the Flammable Fabrics Act, was passed by both Houses of Congress and approved by the President on June 30. This law takes effect on June 30, 1954 and is designed to prohibit the introduction or movement in Interstate Commerce of articles of wearing apparel and fabrics which are so highly flammable as to be dangerous when worn by individuals. The test method prescribed is identical with that tentatively adopted by the NFPA in 1953[3] and now the subject of further study and research by the NFPA Committee on Wearing Apparel. Of the states, California has been practically the only but shining example of control of this hazard by a state.

Special field engineering services carried on by NFPA in the fields of electricity and flammable liquids have proven so successful that a similar venture in the field of flammable gases was launched in 1953 with the support of the gas and liquefied petroleum gas industries.

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[1]See NFPA Pamphlet 13 (June 1953), 50 cents per copy. Reference also the July 1952 *Quarterly*, pages 5 to 18, or NFPA Pamphlet Q46-1, 50 cents per copy, and article, this *Quarterly*, page 205.

[2]Copies available from NFPA Publications Service Dept., cloth cover, $3.00, paper cover, $1.00.

[3]See NFPA Pamphlet No. 702-T, available from NFPA Publications Service Department, 35 cents per copy.

The Society of Fire Protection Engineers, organized two years ago, to gain recognition for this special branch of engineering, continued rapid growth and progress during the past year and shows every evidence of being an important contribution to society.

Education

In the field of fire prevention education, by far the most important development of the past year was the expansion of the fire prevention campaign conducted by the Advertising Council with NFPA as sponsor. This is undoubtedly the greatest mass educational effort in fire prevention ever attempted and *Sparky,* featured as the character of this campaign, is becoming familiar to the general public as a symbol of fire prevention. (See poster reproduction below for typical use.)

Fire Prevention Week again exceeded all past observances in both the United States and Canada. The value of this week must not be under-estimated because of its timeliness in the early fall before the heating season in arousing general civic interest and action on fire prevention measures in hundreds of our communities. The Grand Winner in the NFPA Fire Prevention Week Contest for cities in the United States in 1953 was Philadelphia, closely followed for top honors by Chicago, Memphis and Louisville. The Grand Winner in Canada was Kentville, Nova Scotia, followed by Vancouver and Calgary.

In the year-round Inter-Chamber Fire Waste Contest for 1952 conducted by the National Fire Waste Council of the United States Chamber of Commerce, Stevens Point, Wis. won the Grand Award and with the class winners in order of population as follows: Cincinnati, Memphis, Providence, Racine, Wis., Billings, Mont., and Valley City, N. D.

Modern Fire Department Equipment*

By Warren Y. Kimball

Manager, NFPA Fire Services Department
Secretary, NFPA Committee on Fire Department Equipment

Modern fire fighting equipment of advanced design can be a major psychological factor for fire service morale as well as a material factor in fire fighting efficiency. However, any fire fighting equipment, no matter how advanced in engineering design and manufacture, can only be as good as the men assigned to it are proficient in its use. Our aim should be to provide the best tools for men charged with fire fighting responsibilities. This is only sound business because the biggest fire protection investment is in trained manpower, whether consisting of paid employees in the cities or volunteered time contributed by firemen in smaller communities.

It is the aim of the NFPA Fire Equipment Committee to provide specifications that will enable all communities to obtain reliable, well designed fire apparatus and equipment and, also, to make available information that will help fire departments and municipalities select modern fire equipment well suited to their needs. We are encouraged when major fire apparatus manufacturers tell us that as much as 75 per cent of the apparatus they build is now purchased on the basis of the NFPA-IAFC Standard No. 19, "Specifications for Motor Fire Apparatus."† These specifications are also recommended and distributed by the National Board of Fire Underwriters.

It is disturbing, however, that many fire departments still purchase apparatus from virtually non-existent or incomplete local specifications, frequently resulting in apparatus that is five or ten years behind the times even before it is built. Such apparatus may be underpowered, poorly balanced, under-tired or have other major deficiencies, and frequently costs more than up-to-date, well designed apparatus, simply because it costs more to tailor-make an out-of-date unit meeting local specifications than an up-to-date rig consistent with current good practice. We also regret that so many fire departments fail to consult their local fire insurance rating association before buying apparatus. That is just bad business.

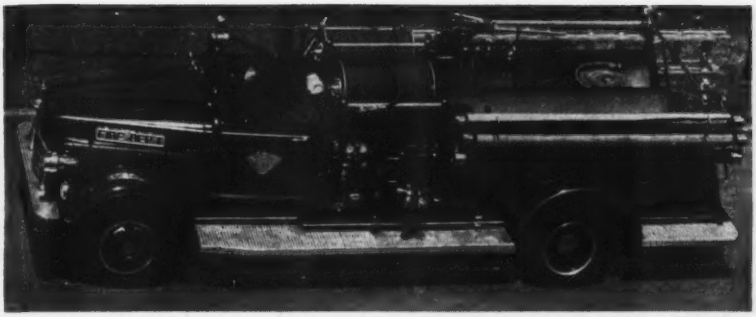
What NFPA Standards Cover

At the present time Standard No. 19 covers four major types of apparatus: pumpers, aerial ladders, pumper-ladder combinations or "quads," and water tank apparatus. Standard No. 192* discusses the equipment and apparatus for Volunteer Fire Departments in some detail and suggests modifications of the basic specifications of No. 19 for rural service. A large part of the specifications in the latter standard apply to all types of apparatus. It is important to know this because there is a growing tendency to purchase special duty equipment, such as rescue, salvage, and forest fire trucks, without regard to the fact that these units are pieces of fire apparatus and should meet the standards of fire service performance. The unfortunate failure to recognize this has been responsible for some poorly designed, overloaded, unroadworthy units whose chief resemblance to fire apparatus is a coat of red paint. It is just as important for the rescue or special duty truck to reach the fire or emergency promptly and surely as it is for the pumper or ladder truck. Certainly the forest or brush fire truck should not needlessly suffer from lack of power or

*Based on a talk presented by the author at the NFPA Regional Conference, Providence, R. I., October 29, 1953.

†Copies available from the NFPA Publications Service Department; in pamphlet form, 50 cents, in contract form, $1.00 each.

*Available from the NFPA Publications Service Department, 50 cents per copy.



Rochester, N. Y. Engine 1, designed by Deputy Chief Louis Vogt and built in RFD's Maintenance Shop, has a 250 gal. water tank, a 750 g.p.m. Class A American Marsh pump (capable of supplying both high and low pressures simultaneously) and a vacuum clutch control switch on the dash which permits the driver to shift from road to pump drive before he leaves the seat. There are four gated 2½ in. inlets for pump supply.

from inferior design. The NFPA standard on "Community Forest Fire Fighting Equipment," although basically sound, is outdated. The Forest Committee is at work on an up-to-date standard incorporating the best current practice in that field.

Combination Pumper

The basic piece of fire fighting apparatus, of which far more are sold than any other type, is the combination pumper or pumping engine, formerly called a "triple combination." The great majority of these pumpers are now manufactured and purchased on the 150 lb. per sq. in. net pump pressure or Class A rating, tested at draft, and giving 70 per cent of capacity at 200 pounds. For many situations, the 200 pound pressure performance, usually provided by a multi-stage pump in series operation, may be of equal or greater importance than the 150 pound rating because many of the fog nozzles are designed to perform best at 100 pound nozzle pressure and added pressure is needed to overcome friction loss and elevation.

Fire apparatus standards do not require net pump pressures in excess of 250 lbs. per sq. in. Most fire pump manufacturers are prepared to furnish pumps capable of supplying small first aid streams of booster hose calibre at pressures which may run as high as 1000 lbs. per sq. in. at the pump. Any fire fighter who understands the facts of life should know that the function of pressure is to give velocity to a stream and that pressure is no substitute for the volume of water needed to cool a fire by absorbing or transferring heat. However, most of the high pressure "gun type" nozzles throw considerably more water than the average of low pressure booster nozzles, thereby somewhat increasing the size of incipient fires that can be handled by the small hose. Whether this trend will increase or die out is not clear, but recent test fires in various parts of the country have served to re-emphasize the importance of adequate volumes of water for prompt control of fires, whether or not the water is applied in the form of solid streams or fog jets. In fact, the 100 gallon-per-minute stream appears to be supplanting the 50 gallon-per-minute stream as more effective for 1½ inch hose. The more rapid extinguishment of the fire actually saves water and reduces water damage as heat production is quickly stopped and the nozzle can then be shut off.

We should stress here that one of the more important features of apparatus meeting Standard No. 19, both from performance and safety standpoints, is road-ability, including both acceleration, so important in safely negotiating traffic,

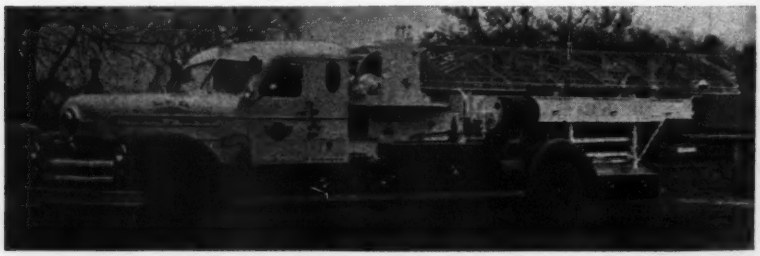
and grade climbing ability. Proper tire sizes, as specified, are hardly less important. Inadequate tires, which endanger the safety of the vehicle and crew, may be one place where a competitive bid may be shaved to the detriment of the purchaser who does not use adequate specifications or does not properly check apparatus against specifications on delivery. The October 1953 NFPA *Firemen** magazine reported that the Dominion Board of Insurance Underwriters (Canada) is now carrying out a complete testing and listing service of fire apparatus which supplements the usual underwriters' 12 hour pumping tests on new assemblies with tests of road performance, weight distribution, priming devices and other vital components. Unfortunately, such complete testing service is not generally available in the United States, although it is encouraging to note that more and more fire departments are giving attention to these important factors in their acceptance tests, in addition to the usual 3 hour underwriters' pumping acceptance test. One underwriters' engineer recently reported that since road performance tests were adopted in his territory, no 500 gallon-per-minute pumper had been delivered with less than a 145 brake horsepower engine and that 250 brake horsepower or larger engines were the rule for larger apparatus. Canadian experience shows that the testing procedure is eliminating underpowered models on commercial chassis from the fire service. After all, adequate chassis are available at reasonable cost, and in the long run will prove more serviceable, reliable, and economical.

*Subscriptions available to NFPA members for $1.25 per year.

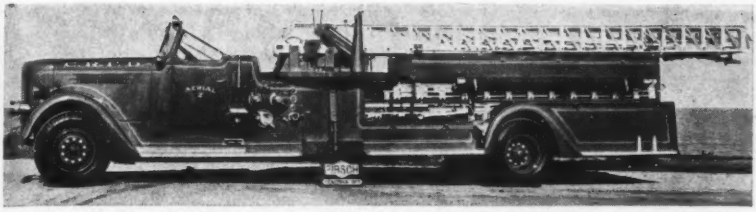
Aerial Ladders

The past generation has seen the service type aerial replace the old city service ladder truck in most city fire departments. Only two service ladder trucks were built last year. Unfortunately, too many aerials carry only a 65 foot aerial or mechanical ladder. The reduction in length of aerials has been a step backward. The 85 or 100 foot aerials can do all that a 65 foot can do, but where there are parked vehicles, building set-backs, terraces, etc. the 65 foot ladder may not have sufficient reach. Accordingly, we look for a re-appraisal of aerial ladders with the 85 foot ladder coming back as a standard for city service and the "junior" ladders relegated to small community service. Traffic and street conditions may indicate whether the aerial is mounted on a service chassis or is a tractor-trailer job.

Ladder pipes are standard equipment for almost all aerial ladders. The separate water tower truck is economically unjustifiable in all but the largest cities, and even in these cities it needs to be redesigned as a water distributor truck with large capacity pump on the vehicle. We also look for a much needed improvement in ladder pipe design along with other



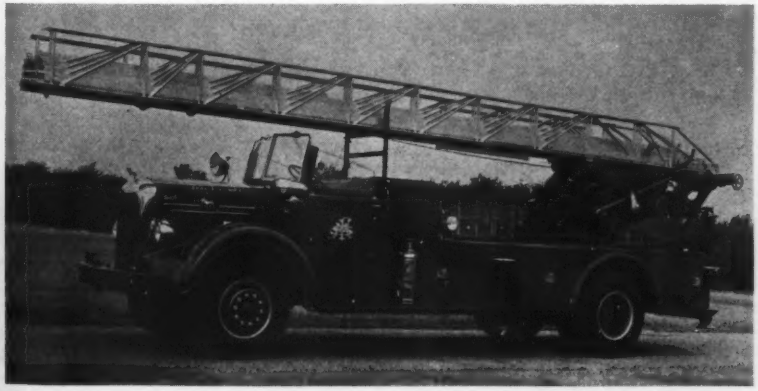
An 85-foot "service type" aerial ladder delivered to the Lansing (Michigan) Fire Department by the Seagrave Corp. The truck has a 4-stage auxiliary high pressure pump and two high pressure hose reels.



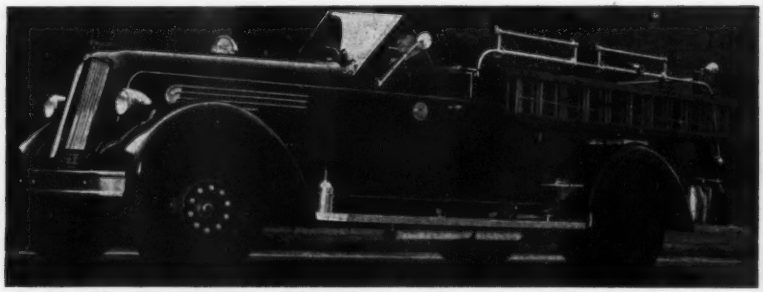
Pirsch quintuple built with 65-, 75-, or 85-foot aluminum alloy aerial ladder and 200 ft. of wood or aluminum alloy ground ladders, 100 gallon booster tank and 750, 1000, or 1250 g.p.m. pump.

heavy stream nozzles. Improved large capacity hose will permit a better supply for ladder pipes. We deplore the fact that many fire departments try to supply ladder pipes with a single 2½ inch line leading up the ladder from the siamese. We cannot think of a more certain way to limit the performance of a ladder pipe, except in cases where the pipe is incapable of handling more than 300 gallons-per-minute. A heavy stream pipe carrying 400 to 1000 gallons-per-minute needs 3 or 3½ inch hose.

Frequently, we are asked whether we believe in providing a pump on an aerial ladder. The answer to this is that NFPA Standard No. 19 calls for at least a 200 gallon-per-minute booster pump on aerial ladders. There are many instances where pumpers may be out of quarters, and it can be very embarrassing if the ladder truck arrives first and has nothing with which to fight a fire. Also, with small chimney and roof fires the booster pump on the aerial can be mighty convenient. If a ladder pipe is to be used, a 750 gallon-per-minute pump at the base of the ladder is extremely helpful in providing an effective stream. The power plant is there anyway and the cost of providing the pump is minor in comparison with the cost of the entire unit. We personally would not ordinarily favor companies operating a so-called "quint" (aerial with pump) as a one piece pumper-ladder company, but think that the extra pump can be a useful adjunct for heavy stream operation, especially where it is necessary to relay large volumes of water several hundred feet.



A Magirus aerial ladder mounted by Maxim on a Mack chassis for Montreal. The relatively short 203 inch wheelbase and the self-leveling feature of the Magirus design are features which make this assembly desirable for congested city use.



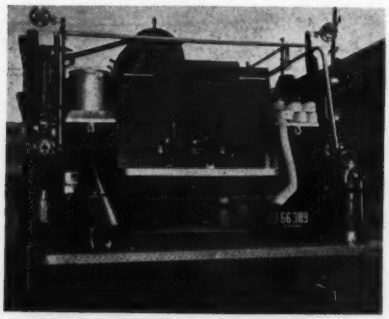
This San Francisco "Booster Wagon" has a 500 gallon water tank, dual reels of 1 inch hose with combination fog nozzles. (See also photo lower left.)

Auxiliary Apparatus

With manpower a problem in many departments, and all too many cities having too few fire companies in service, considering area, required coverage and response as well as frequency of calls, there appears to be a tendency to supplement heavy duty apparatus with small auxiliary fire trucks. These can be manned with details of two or three men, as needed, in order to keep the heavy apparatus in quarters. The auxiliaries answer calls for grass and automobile fires and also are capable of providing small stream service for routine fires. While these booster or tank units appear to be a modern extension of the old chemical company before the "triple-combination" put all the fire fighting eggs in one basket, they are becoming a highly important part of the fire defenses of many communities, including cities as large as San Francisco and Salt Lake City. These units may carry foam, wet water, and other special equipment including a monitor nozzle in addition to water tank and small hose.

Nozzles

It is only in the last few years that significant engineering has gone into the design of nozzles to project water in fire stream patterns for maximum effectiveness. For years, conventional nozzles consisted of a straight stream orifice measured in inches, having one or more threaded fire hose inlets and possibly a shut-off valve. Little effort was made to



Rear end of SFFD "Booster Wagon" showing water tank, pre-connected 1½ in. line with fog nozzle, foam generator with hopper and foam supply.

A Salt Lake City auxiliary which is radio equipped and carries in addition to booster tank, pump and reel, back-pack extinguishers and foam supply.

The Miami Fire Department has these three "Chemical" trucks, each with a 500 g.p.m. centrifugal pump and a 500 gallon tank of "wet" water. There are several pre-connected 1 ½-inch hose lines with fog nozzles on each unit.

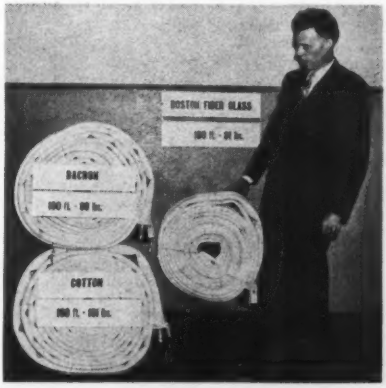
relate nozzle sizes to pumper discharge performance. Gross inefficiencies in waterway design have been tolerated, especially in heavy stream devices, where a needless load of upward of 15 water horsepower may be imposed by inadequate waterway design. We are beginning to see the introduction of heavy stream nozzles with adequate waterway design using industrial type high pressure swivel couplings and tips designed for desired flows at given pressures so that a fire chief can call for a 250 gallon tip, or 500 gallon tip, as the case may be. Nozzles will improve as fire departments specify and purchase nozzles having better performance.

Studies of fire department fog nozzles conducted last year by the Fire Department Equipment Committee and published by NFPA* spot-lighted wide variations in nozzle design and performance. For example, some 1½ inch fog nozzles throw more water than certain 2½ inch fog nozzles. Many fog nozzles chiefly designed for flammable liquid fires have been used for Class A fires. Some of these have inadequate volume and reach for most effective work inside buildings. Manufacturers recently have introduced nozzles with selective stream control and flows engineered to meet definite discharge requirements. This is in recognition of the fact that pressure does not put out fire but rather that extinguishment of Class A fires is dependent upon adequate cooling capacity and the ability to project the water where it can readily absorb and transfer heat.

*See NFPA Pamphlet "Fire Department Fog Nozzles" $1.00 per copy and the October 1952 NFPA Quarterly, pages 149-157.

Hose

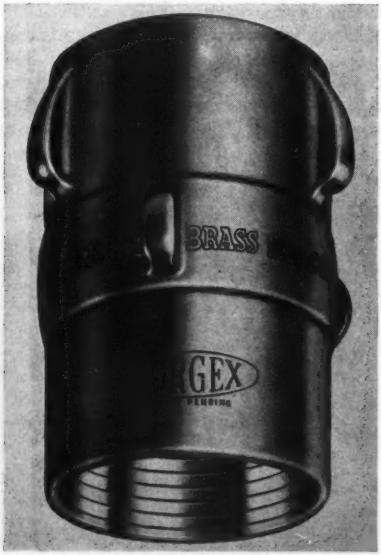
For a long time it has been no secret to students of fire service hydraulics that the commonly used 2½ inch fire hose does not have water carrying characteristics in proper balance with modern pumping capacity and fire nozzles. Even 1½ inch hose is inefficient or inadequate in capacity for many of the 1½ inch fog nozzles now in use. However, new synthetic fabrics make promise some of the greatest improvements in fire hose construction since cotton rubber-lined hose replaced riveted leather hose in the past century. Most persons in the fire service are aware that "Dacron" fillers have been



Competitive designs of 50-foot lengths of fire hose. The Boston Woven Hose Co. is now offering a rubber-lined fiber glass hose.

used recently in fire hose construction. An all-Dacron jacketed fire hose was exhibited at the International Association of Fire Chiefs' 1953 Conference in Toronto. Such synthetic fibres are said to reduce hose weight, increase flexibility, improve resistance to mildew. One prominent hose manufacturing company announced production of rubber-lined hose having fibreglas yarn in the jacket. This is said to provide a flexible high strength hose, even lighter than some of the hose using "Dacron" fillers. A significant thing for the fire service is that the lighter construction of the improved hose should make possible an increase in internal diameter with the same nominal coupling sizes. As pointed out in the November 1953 *Firemen* magazine, an increased internal diameter of nominal hose sizes would increase the flow at a given pressure loss or reduce friction loss to a very significant degree.

Coupled with improvements in fire hose are improvements in hose couplings



A new lightweight coupling by Akron Brass. The manufacturer claims this forged product weighs only half as much as ordinary couplings and has greater strength.

Navy fire fighters using Solar Aircraft Co.'s gas turbine pump. The pump weighs only 165 pounds yet will deliver 500 g.p.m. at 100 p.s.i. for a 16 ft. suction lift. Note fuel supply can on top of pump.

such as new drop-forged couplings, combining lighter weight with strength.

Because of limited production, the cost of some of the new improved items may be higher initially than the more conventional type, but quality and performance should be of prime consideration in municipal fire protection. A few cents more per foot spent for hose frequently can be written off in longer life, not to mention ease of handling and better performance.

Portable Pumps

While most urban pumping is done from hydrants, pumping from static sources with portable fire pumps (frequently out of reach of heavy hard suction hose) is commonly done with portable fire pumps at rural fires. NFPA Standard No. 19 recommends that a portable fire pump be carried on all rural apparatus. There have been some cases where small volume, high pressure forestry pumps have been confused with portable pumps suitable for structural fire fighting service. NFPA Standard 191* on the subject of portable pumps specifies at least 100 gallons-per-minute discharge at 60 lbs. per sq. in. pressure, and 50 gallons-per-minute at 90 pounds pressure. Several portables are available that also

*See NFPA Advance Reports, 1953, pages 163-166 and Proceedings, 57th Annual Meeting NFPA, 1953, pages 83-84.

give 200 gallons per minute at 30 pounds pressure.

Current fire defense planning, taking into account wartime fire experience and possible failure of hydrant pressures, has led to renewed interest in portable fire pumps. The British are building 5000 Civil Defense portable pumps discharging about 350 gallons per minute (U.S.) at 100 pounds, but the weight of these machines is considerably above that normally considered portable in the United States and Canada. Recently, at the instigation of the United States Navy, a jet turbine driven portable pump operating at 40,000 revolutions per minute has been developed for the fire service. This pump delivers 500 gallons per minute at 100 lbs. per sq. in. and 750 gallons per minute at better than 60 lbs. per sq. in. While this unit is costly at present, it is interesting because it is the first truly light weight portable that can provide full capacity for an average pumper. It is likely that other pump manufacturers will introduce light weight portables capable of supplying 500 gallons per minute to a pumper through 250 or 300 feet of 3 inch hose or dual lines of 2½ inch hose. This flow is needed, especially to improve rural fire service.

Jet Syphons or High Lifts

Along the same line of supplying pumpers with water, another familiar device is being enlisted as a fire service tool. Jet type pumps, long used to lift water in deep wells and also used for dewatering basements, may be pressed into fire fighting service to permit pumps to take "suction" over appreciable distances and at lifts impractical with ordinary hard suction, dependent upon atmospheric pressure. Published reports, based upon tests by the United States Forest Service's Acadia Laboratories, even venture the opinion that with adequate research the ejector might supplant the hard pumper suction hose in rural service. After all, it does not make sense to have a pumper capable of developing pressures of 250 lbs. per sq. in. or more, entirely dependent upon 14.7 lbs. per sq. in. atmospheric pressure to supply the pump at draft, severely limiting the length of suction and lift. NFPA *Firemen* magazine for December 1953 published accounts of experiments with ordinary commercial eductors (also called "ejectors" and "suction boosters") conducted by the San Diego Fire Department and by the U.S. Forest Service Acadia Laboratories. High lift "suction boosters," employing a similar principle, are already on the market for fire service use.

San Diego uses this eductor (or ejector) for lifting water from basements and ship holds. Three inch hose is connected to the discharge side and 2½ inch hose to jet side. Note strainer on suction side.

Power Equipment and Tools

With manpower the most valuable item in the fire service, whether paid or volunteer, the day is fast passing when we can afford to use manual labor where power equipment can do a better and quicker job. Just as the carpenter uses a power saw, electric drill, planer, and sander, so the fire fighter must replace the hand axe for difficult jobs with such tools as power saws, drills, and rotary cutters. In fact, progressive departments are already doing this. Hand jacks are being supplanted by hydraulic jacks. Some fire departments use hydraulic door openers which usually can spread a door frame without damage and with a minimum of time and effort.

Electric power is a must in modern fire fighting, not just for illumination but for work energy. The day is not far away when an alternator will be standard equipment on all fire department vehicles, including officers' and shop cars, so that power tools, lights or any other equipment requiring a reasonable amount of

alternating current can be operated, without waiting for special lighting plants or generator units. Needless to say, power tools can save fire fighters a lot of punishment. In many fire departments, power blowers or ventilators are standard equipment and a truckman takes a blower as one of the basic tools when entering a building. These may be used both to bring in air as well as to exhaust smoke. Doubtless the day is not far away when compressed air lines or other air equipment will accompany the hose line.

Smoke Damage Reduction

A number of departments are using deodorants in conjunction with their blower equipment and some reports of reduction in smoke damage have been sensational. Good results have been obtained in public relations at even minor fires. In one case an estimated $400,000 smoke loss was cut to about $8,000. Fire departments wishing to give high quality service cannot long overlook such opportunities to greatly reduce incidental fire damage. Some of our member departments report that they carry a vacuum cleaner on their salvage rig or service truck and find that it is excellent for removing soot and smudge occasioned by faulty oil burners.

Hose Handling

Other power equipment finding acceptance in the fire service is the power operated hose reel which speeds the job of getting the small line back on the truck ready for another call. This is also important where the truck must leave a fire to refill its tank. Another factor in speeding up fire service is pre-connected 1½ inch, 2 inch, and 2½ inch hose lines carried attached to pump outlet valves with nozzles already attached. This permits a pumper stationed close to the fire to immediately place two or three good pressure lines in service from the tank, backed up, as needed, by 2½ inch or 3 inch hydrant supply lines. While the standard specifications call for one 2½ inch gated inlet, many new pumpers have two 2½ inch gated inlets for this purpose and some cities specify four inch inlets.

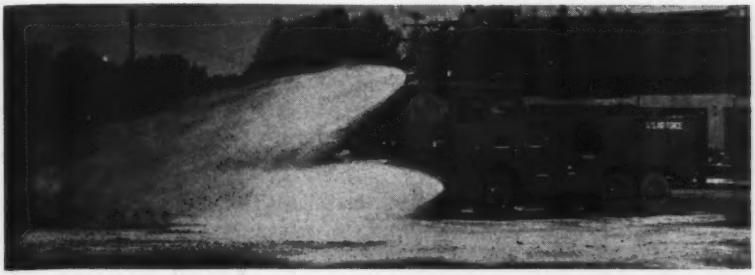
It also is to be hoped that more departments will realize the advantages of divided hose bodies and that additional compartmentation will become standard in the future. We can think of no more simple expedient for greatly improving operating efficiency on the fire ground.

Personal Equipment

We have said little about the fire fighters' personal protective clothing, but that, too, should be subject to improvement in weight, heat and cold insulation and wearing qualities, just as the military has improved the combat clothing of their fighting men. Fire helmets are a must in the fire service, but research and experimentation should be conducted to see if improvement can be made to overcome certain deficiencies, such as the lack of an effective heat shield for the face, and a back apron to protect against embers. Also, the helmets' resistance to impact should be studied. The British have developed a glass fibre helmet that is non-conducting, yet said to be sturdy but reasonably light in weight.

Breathing Apparatus

With the fire fighter becoming a skilled technician who must be familiar with a wide variety of subjects and able to operate a host of specialized appliances, his health and mental alertness can no longer be needlessly sacrificed by old fashioned "smoke eating." Protective breathing apparatus, already required by law in three states, will become a must for every individual fire fighter. This equipment will be self-contained, light in weight, and relatively simple to use. Several of the member departments visited by the writer recently have a self-contained breathing apparatus for every man on duty. Some give the fire fighter an option as to whether he prefers to work with fresh air or oxygen. The part played by inhalators and resuscitators in the fire services is too well known for comment other than to say that in many communities the fire departments answer more rescue or ambulance calls than they do fire calls. Fortunately, these seldom require a large response of manpower



First Postwar U. S. Air Force truck is this type 0-10 shown here dispensing fog-foam. Overhead turret and ground sweep nozzles are remote control Rockwood equipment. The vehicle carries 550 gallons of water and 50 gallons of foam. (For details see NFPA Aviation Bulletin No. 73, 50 cents.)

as is necessary for fire fighting. However, in some communities where only a few firemen are on duty, these calls may reduce the available fire fighting force unless additional personnel is provided.

Airport Protection

Some constructive thinking on new fire equipment comes about as a result of increasing awareness of the need for specialized protection for airports. The World War II aircraft rescue and fire fighting vehicles, developed by the Air Force and Navy, are now being replaced by new equipment.

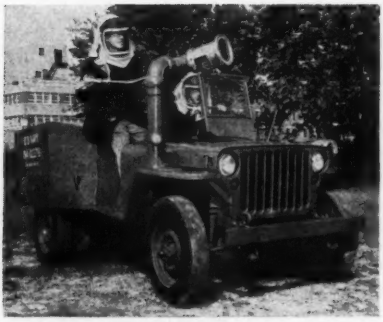
Air Force Developments

U. S. Air Force has recently produced and placed in extensive service their so-called Type 0-10 crash truck which is a 26,700 lb. vehicle with a 550 gallon water tank and a 50 gallon foam tank. This vehicle is basically a fog-foam unit. Recent deliveries of this vehicle include a 20 gallon supply of chlorobromomethane which replaces the 200 pound carbon dioxide system found on earlier production models. In this vehicle, the foam is discharged through a combination of turret, ground sweep nozzles, under-truck nozzles and hand lines. The roof-mounted turret is operated by an elaborate remote control system from inside the cab. The original vehicles delivered had some severe maintenance problems. The switch to chlorobromomethane is somewhat of a "shocker." So far as is known, no comprehensive tests were conducted which dictated the switch to this vaporizing liquid extinguishing agent. The Air Force is currently putting its second big Postwar truck, the Type 0-11A, through its final tests prior to mass production. This second fog-foam unit has two turrets and approximately 1,100 gallons of water. We are assured by U.S.A.F. Headquarters that it will be infinitely superior to the original versions of the 0-10.

Both of the Air Force trucks are designed for all climate, world-wide service and thus all the units are winterized so that the vehicles might operate where temperature conditions are as low as minus 65°F. Many feel that such total winterization of all units is standardization to the extreme, at the expense of the taxpayer.

Navy Developments

In the meantime the U. S. Navy has been doing considerable research in aircraft crash fire fighting and they have concentrated on the development of a foam "Jeep" type vehicle to be backed up by a 6,000 gallon-per-minute major foam crash rescue truck. The "Jeep," which the Navy calls the "Little Squirt," has a gross weight of under 3 tons, a 230 gallon aluminum water tank, and a 20 gallon tank of a "tailor-made" foam especially developed by the Naval Research Laboratory. The foam output is 1,200 gallons per minute with a 11.5 expansion ratio. The entire discharge is



This Navy experimental Jeep foam rescue vehicle is designed to operate in 3 seconds and be extremely and quickly maneuverable.

through a single turret and a new foam pump described as flying vane type pump. Operating at 1,100 revolutions-per-minute, a straight stream of foam can be thrown 90 feet and the "snow-foam" pattern 52 feet.

This truck was used by the Navy in its experimental work with 11 expansion foam and the new flying vane type foam pump. The prototype production model is scheduled for testing in early 1954.

The "Big Squirt," the Navy's new experimental 6,000 gallon-per-minute truck is to have a 1,250 gallon water tank, an 80 gallon foam liquid tank and utilize the same high expansion foam. More details appear in NFPA Aviation Bulletins Nos. 99 and 101.*

*Available from the Publications Service Department, 50 cents each.

Civilian Airport Work

At civilian airports, activities have been varied. The large Walter-Maxim crash trucks originally placed in service at the Port of New York Authority airports represent the largest units in commercial service. One of the latest Walter-Maxim trucks delivered is in service at the Washington National Airport and has two turrets suitable for dispensing either straight stream foam or a spray pattern fog-foam. The range of the spray pattern may be as high as 65 to 70 feet. Boston's Logan Airport has a Walter-Maxim truck but this one is different from the others in that it has mounted on it a dry chemical tank with a hose line.

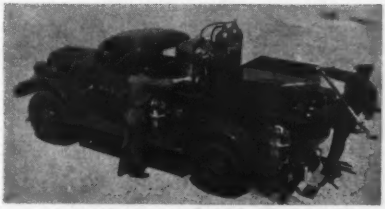
This Walter-Maxim airport rescue and fire fighting truck in service at New York airports has positive 4 wheel drive to negotiate difficult terrain off runways.

Smaller airports have gone for standard chassis. Some airports have purchased combined crash and structural fire equipment since municipal response to the airport would be considerably delayed due to the distance involved. Small "Jeep" equipment, particularly units employing dry chemical, have also been purchased by airports designed to control incipient aircraft fires. Large capacity, low-pressure carbon dioxide vehicles have been purchased by several airports. The Air Force has also under construction a new winterized carbon dioxide truck to take the place of the World War II famous "Class 150" crash truck. Most of the carbon dioxide trucks used at civilian

Airports located outside fire districts need combined structural and crash units. This vehicle in service at Broome County Airport (N. Y.) is backed by a 2,000 gallon auxiliary water tender. The turret discharges foam at a rate of 1200 g.p.m. at 150 p.s.i.

airports have reduced the bulk liquid carbon dioxide supply by one-third in order to get greater vehicle mobility and speed. The rates of discharge have been kept high, consistent with recommended procedures.

The developments in the crash protection field have been towards the better employment on improved vehicles of the combined agent technique of crash fire fighting using carbon dioxide and foam, that saved many lives in military operations and is recommended in NFPA Pamphlet No. 403.* Dry chemical has entered into the picture, especially in relatively small quantities (up to about 400 lbs.). Some experimental work has been done with larger quantities of dry chemical and continuing experiments are



A 1000 lb. Ansul dry chemical unit on a Dodge Power Wagon is in service at the Salt Lake City Airport.

*Available from the Publications Service Department for 50 cents per copy.

Chicago has this 4,500 pound low-pressure carbon dioxide Cardox truck on a Autocar chassis. The truck also carries 230 gals. of foam solution for "combined agent" technique of aircraft fire fighting.

being conducted to determine if dry chemical in large quantities might be substituted for carbon dioxide. The work of the Naval Research Laboratories in making improved foams may influence developments measurably in the next few years.

Communications

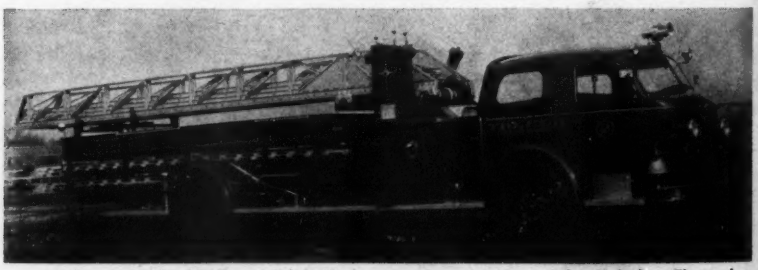
Few can doubt that communications equipment will play a major role in the progress of the fire service. Fire apparatus is no longer tied to its "fire barn" by dependence upon land-line communications. In Providence, Rhode Island, for instance, fire companies regularly inspect their districts, keeping in touch by radio. Radio also makes possible more fluid move-ups of fire equipment toward areas of danger. Just as baseball fielders move toward a particular part of the field in accordance with a batter's demonstrated record, during dry seasons fire companies can go out on the air to be nearer high hazard areas.

Recently, one city has announced that high frequency radio will connect outlying box circuits with fire alarm headquarters, and that these micro-wave circuits will be under constant electrical supervision. The development of tiny radio capacitators and transistors promises to make emergency communications truly portable.

Conclusion

It should be clear that municipal or public fire apparatus and equipment must be designed and provided to handle any class of fire. The day when a fire department was equipped to handle only "Class A" fires and experienced confusion and consternation over even a small flammable liquid or electrical fire should be in the dim past. Because it is relatively plentiful, water will no doubt long remain our basic extinguishing ingredient, whether treated with wetting agent to facilitate penetration, or treated with foam compounds to provide a blanket for smothering. Foam and wet water proportioners on apparatus and for inline service are almost too commonplace to be considered "new developments," except for the fact that continued progress can be expected in the act of treating water to make it a more efficient extinguishing agent. In this connection, we might well observe that there are considerable differences in water as found from community to community.

The improvements discussed here and many others will come to the fire service as fire department officials specify and use improved types of equipment. Therefore, our advice is to buy the best in fire fighting equipment. Use good practice specifications and be sure to use specifications that are up-to-date. Be careful that you do not circumscribe manufacturers and prevent them from giving you improved equipment. Obsolete provisions in your specifications can give you apparatus or equipment that is years behind the times when delivered. Your NFPA Fire Department Equipment Committee is constantly anxious to assist you by the development of improved equipment standards.



A four wheel 100 ft. aerial built by American-La France for Toledo. The cab-ahead-of-engine seats 5 men. The engine may be either 215 or 275 H.P. Aerial ladders are hydraulically operated.

Large Loss Fires of 1953 – Summary

An NFPA Staff Study

During the year 1953 there were 293 fires in the United States and Canada with individual losses of $250,000 or more. These 293 large loss fires caused 336 deaths and produced an aggregate loss of $274,374,500. Thus, about 0.01 per cent of the fires in the United States and Canada caused 24 per cent of the total fire waste (estimated at $1,160,000,000) in the two countries.

The number of large loss fires in 1953 was 6.5 per cent greater than in 1952 when 275 occurred. The 1953 loss figure for the 293 fires was the largest on record, an increase of 50 per cent over 1952!

Individual accounts of these serious fires are given in this *Quarterly*.

Sources of Information

These large loss fires, by virtue of their size and importance, have received, in most instances, careful scrutiny by investigating authorities and have thus been reported to the NFPA in sufficient detail and accuracy to permit analysis. The application of the lessons from these fires will accomplish a reduction in the number and effects of fires of all magnitudes.

In preparing this study and in selecting the fires which should be included, every effort has been made to verify the loss figures but they only show the general magnitude of the damages sustained. All figures represent an estimate of the actual fire losses with the exception that, where available, the Association has added figures indicating insurance losses paid due to business interruption.

Principal Occupancy Classes

In the table below, the number of large loss fires in the major occupancy classes are presented. Accounts of the individual fires in other parts of this issue of the *Quarterly* are given in similar groups except that the transportation and miscellaneous classes are further subdivided for the reader's convenience.

Occupancy Class	No. of Fires by Years				
	1953	1952	1951	1950	1949
Manufacturing	105	88	99	83	67
Storage	48	44	50	23	43
Mercantile	29	38	49	29	26
Transportation	39	48	36	31	23
Residential	11	13	8	11	11
Miscellaneous	61	44	60	66	48
Totals	293	275	302	243	218

Geographical Distribution

Geographically, the greatest number of large loss fires in buildings occurred in the State of California which had 21. New Jersey had 16, New York 14, Michigan, Ohio and Pennsylvania had 12 each, Illinois and Ontario 11 each, and Texas 10. Canada sustained 26 of the major building losses.

Principal Factors Analyzed

A study, summarized in the following paragraphs, has been made for the purpose of selecting the significant features in all these large loss fires involving structures (excluding transportation). Separate studies introduce each of the special articles on the major occupancy classes included in this *Quarterly*.

Location of Property

Almost as many large loss structural fires occurred in towns of less than 20,000 population (or in unincorporated areas)

as in the larger cities of 20,000 or over. This shows that the large loss fire problem is a problem for the small town as well as the big city. Operators of high valued properties in the small community or outside of incorporated areas must provide full scale exterior as well as interior fire protection.

Construction

About 87 per cent of the large loss building fires occurred either in brick, wood-joisted buildings or in wood or wood-frame, metalclad buildings. Nine per cent of these serious fires occurred in noncombustible or heavy timber structures and only 4 per cent in fire-resistive buildings. As would be expected, 86 per cent of the mercantile occupancies were housed in the brick, wood-joisted buildings, the conventional older type construction found in American built-up city areas. Civil Defense officials should take heed of the effect of these structures on the vulnerability of metropolitan districts to war-time bombing raids.

Although it is recognized that the combustibility of the contents is a vital factor in the seriousness of a fire in buildings of any construction, this record does show the inherent vulnerability of buildings having combustible elements.

Detection

Occupants were the first to discover 40 per cent of the fires which subsequently caused losses in excess of $250,000. This shows that in a property subject to "large loss" the fact that people are in the building does not necessarily guarantee prompt detection and fire control.

This year, the records show that outsiders were the first to discover 41 per cent of the fires which developed into large losses. This is consistent with the 42 per cent reported in the summary of 1952 large loss fire experience in last January's *Quarterly*.

Watchmen were the first to detect 7 per cent of these serious fires. In 16 instances, however, watchmen failed to detect the fires promptly. (See also section headed "Automatic Detection" below.)

There are significant variations among the broad occupancy classifications as shown by the fact that outsiders detected 30 per cent more of the fires that destroyed mercantiles than those that destroyed manufacturing plants.

It can be inferred, therefore, that many potentially disastrous store fires that break out during operating periods cause relatively little damage because someone was on the property to detect them promptly. However, the fact that seven large loss store fires broke out when employees were present emphasizes the previous assertion that complete reliance for prompt fire detection and control cannot be placed upon sales clerks, stock boys and other employees hired for specific duties not related to fire protection.

Among the reasons for the greater employee detection of incipient fires in manufacturing plants are (1) longer working hours and (2) more fires caused by operating hazards. It follows that knowledge of what to do in case of fire is particularly important in industrial occupancies. Procedures for calling the fire department, assembling the fire brigade and using fixed and portable fire appliances should be prearranged.

The serious warehouse fires were evenly distributed during the day and night, reflecting the infrequent occupancy of such properties.

The natural "lessons" from this experience point to the validity of the claim that automatic protection is essential. In properties not so protected, trained watchman service is needed.

Alarm Transmission

The reliance placed on the telephone for alarm transmission was reemphasized by the study of the 1953 large loss fire record. About 63 per cent of all the alarms were reported by this means as contrasted with 20 per cent reported by fire alarm boxes, and 5½ per cent by automatic equipment. In 39 cases fire department notification was delayed following detection of the fire. Occupants fought fires unsuccessfully in 13 instances before calling for help. Principal other reasons for the delays included 6 instances where telephones were inaccessible, 3 cases where telephone wires were burned and 7 fires at which observers investigated smoke, called police or otherwise delayed prompt fire department notification.

Causes

Research on fire causes is most difficult in the large loss fire experience since so many of these fires are beyond control when discovered and evidence of fire origin is destroyed. In 73 cases causes were determined with reasonable accuracy. In 28 of these the hazard was considered "special" to the occupancy, in 35 a "common" hazard was involved, and in ten, the fires were of incendiary or suspicious origin. Of the known causes, electrical faults were responsible for 14 fires; ignition of flammable liquids caused 11 fires; welding and cutting torches 7; and friction sparks 5.

Sprinklered Properties

Sixteen of the properties involved in these large fires were provided with complete automatic sprinkler protection and yet the loss to the structures and their contents totaled $14,570,000. Because of the outstanding record of sprinkler efficiency in controlling and extinguishing fires in their incipiency, it is of vital importance to study the "whys" of these 16 fires.

A close study shows that in one case, sprinklers satisfactorily performed their design and installation function despite the $750,000 loss which occurred. This loss (in Farmingdale, New York, on December 7) involved a jet type aircraft on the production line. Flammable vapors, trapped in the fuselage due to spillage, were ignited, presumably by a spark from the aircraft electrical system. Five sprinklers restricted the fire so that damage to the structure was negligible and afforded the fire brigade opportunity to extinguish the aircraft fire with standpipe hose streams and extinguishers.

In four cases sprinklers were not really a factor in the loss, since in each case the fire was preceded by an explosion that wrecked the sprinkler system. In one case (April 30, Peabody, Mass.) a plastics manufacturing plant sustained a $390,000 loss when acetone vapors released from a reaction vessel exploded violently and wrecked the building. A leaking gasket on a lacquer mixing kettle allowed flammable solvent to be released at a paint and lacquer factory at Windsor, Ontario, May 7. Explosion of the vapors knocked down building walls and damaged sprinkler piping. On January 14 at Lancaster, Pennsylvania, an explosion caused collapse of a 60-ft.-high building containing linoleum drying ovens. A wood dust explosion in a sawdust fuel bin in a woodworking plant at North St. Paul, Minnesota, caused severe structural damage to the boiler room and

broke sprinkler supply piping so that the protection was nullified.

Unsatisfactory sprinkler performance could hardly be blamed for the large losses at the rubber warehouse in Philadelphia on June 22 and at a cotton warehouse at Vicksburg, Mississippi on December 5. The Philadelphia fire broke out after the building collapsed due to overloading and at Vicksburg the fire broke out in the contents after a tornado had blown down the building.

Unsatisfactory sprinkler performances occurred in the other 9 fires. Four of these fires reached large loss proportions because the occupancy hazard was too severe for the sprinkler systems as installed. At Fall River, Mass., on January 21, at Wilmington, N. C. on March 9 and Huntsville, Alabama, on December 27, residues of the materials being handled overcame the protection provided by sprinklers because of the rapidity of flame spread. In the Fall River case over 114 sprinklers operated in the three-story textile mill, but from the evidence of the charring of the ceiling it was apparent that the water supply was overtaxed, being poor at some sprinklers and non-existent at others. In the Huntsville case, oily lint on structural members was quickly ignited and because all sprinklers opened simultaneously, the weak water supply was overtaxed. Sodium nitrate-impregnated wood caused the Wilmington fire to spread rapidly throughout the structure. At Indianapolis, Indiana, on Nov. 13, fire originating in a large pile of wax paper entered a concealed wall space before it could be controlled by water discharging from sprinklers.

Closed valves denied water to sprinklers in fires at the vacant building being renovated in Providence, R. I., a veneer plant at Statesville, N. C. and a wood flooring plant at Whelen Springs, Arkansas. At Providence, the valve was closed during alterations to the sprinkler systems. At Statesville, nobody could explain why sprinklers in a drier were shut off nor would anyone give an explanation for closed valves at the start of the fire at Whelen Springs. The valve was opened during the latter fire.

In the other two cases where sprinklers did not prevent a large loss, high piling of stock prevented effective sprinkler discharge at the Stein Bros. Paper Box Company building in Chicago on December 16. At Coudersport, Pa. all sprinklers in an undivided building of 66,576 square feet opened and overtaxed the single source water supply which consisted of a six-inch low pressure main. No connections were provided for fire department pumper connections.

Partially Sprinklered Buildings

There were seven fires in partially sprinklered buildings whose aggregate loss totalled $69,959,500 including a $55,000,000 loss at the General Motors plant in Livonia, Michigan on August 12.

In six of the seven cases fire originated in the unsprinklered portions of the properties involved and in one case the fire was shielded from effective sprinkler operation because a large drying oven was unprotected. These partially sprinklered properties included the Livonia fire, losses at Halifax, N. S.; Windham, Maine; Philadelphia, Pa.; Thompsonville, Conn.; Paducah, Ky., and Whittier, Alaska. The Alaskan loss is set at $10,000,000 because of concentrations of Army supplies in warehouses on a 2,223 foot pier.

Automatic Detection

Eleven properties in which automatic detection equipment was installed expe-

rienced large loss fires. Losses from these eleven totalled $5,232,500. The number of large loss fires during 1953 in properties protected by this type of equipment was the largest on record in the NFPA's yearly study.

In three cases, at Oklahoma City on February 18, in Terre Haute on November 11 and Sioux Falls on June 7, the fires originated outside the area under immediate protection of the equipment. In the Oklahoma City case the fire started in vegetation outside the building; at the bean cannery in Terre Haute the fire started in a truck containing scrap paper left unattended over Armistice Day; at Sioux Falls an electrical short-circuit behind a panel board originated the fire and flames spread in this concealed space for some time before heat operated the detection equipment in the building.

In two cases, one involving dust and the other a solvent, flash fires occurred and while the detection equipment operated immediately, the extent of fire upon arrival of the fire departments was such that the fires could not be readily controlled. These two cases occurred in Louisville, Ky., and San Francisco, Calif., the former a paper box manufacturing plant and the latter a furniture storage warehouse with refinishing operations.

At Pajaro, Calif. in the plant of the California Berry Freezers, firemen were summoned by the detection equipment promptly but had difficulty in locating the fire due to dense smoke and were also handicapped by inadequate water supplies during the early stages of the fire. At Baltimore, Maryland, a similar situation confronted firemen as the fire was apparently confined to the egg room of a 3½ acre, one-story building but heavy stocks of groceries, combustible partitions and lack of accessible hydrants permitted the fire to enter a concealed space and go beyond control.

There is no suitable explanation for the extent of fire at time of fire department arrival in the four other cases. At the foam rubber plant in Jersey City on June 10, in the metal working plant in Vancouver, B. C. on June 13, at the fish cannery in Monterey, Calif. on October 24 and at the cosmetic warehouse in Hollywood on March 9, extensive fires were in progress as fire equipment reached the scene.

It should be emphasized in connection with these 11 fires that in each case the automatic fire detection equipment functioned to give the alarm to either a central station or a fire department. Seven of the properties had central station supervision of their detection equipment, and in four the automatic detection equipment was connected directly to fire department headquarters. All eleven installations utilized rate-of-rise devices, and all were listed by Underwriters' Laboratories and presumably were installed in accordance with existing standards.

Spread to Exposures

As in 1952, one in every 3 fires involved more than one building! It is interesting that the reasons for the involvement of exposed properties were also identical in that there were 44 cases in which structural weaknesses were deemed primarily responsible. In 9 cases it was noted that there was inadequate separation between structures despite the fact that space was available to provide adequate fire breaks.

A. P. Newsphoto

Aug. 12, Livonia, Mich. This view of the General Motors plant fire shows how impossible it was to control the blaze which burned over the undivided 34.5 acre building. No fire walls were provided in the main manufacturing area and only partial sprinkler protection was installed at the time of the fire. For full details, see October 1953 NFPA Quarterly or NFPA Pamphlet No. Q47-2 (25 cents per copy). See also, page 281 of this Quarterly.

Major Manufacturing Losses in 1953

U. S. and Canadian fire losses in manufacturing plants in 1953 were more severe than in any other year in history! The year was marred by 105 fires with losses over $250,000 each, more than ever before.* The total loss from these 105 fires reached the staggering total of $108,770,500. Sixty-four employees were killed in these disasters.

General Motors Experience Repeated

The largest industrial fire of 1953 and in history occurred on August 12 at the General Motors plant at Livonia, Michigan. Property damage was about $55,000,000. In the NFPA report on this disaster† it was pointed out that while this fire was particularly severe, the seven fire protection weaknesses in evidence repeated the experience of past large loss fires. The 105 fires reported herein reflect the validity of this evaluation.

1. In 62 of the 105 large loss fires, lack of fire division walls or partitions were judged significant after detailed analysis of the factors contributing to the spread of fire.

2. In 68 of the 93 plants affected by the large fires where automatic protection was feasible, no such protection was available to cope with the fires in their incipient stages. In addition to the General Motors plant, four others had only partial sprinkler protection and in each case the fire originated in an unsprinklered area and overtaxed the incomplete systems.

3. In 23 of these large fires, flammable liquids were involved and in 14, dusts in suspension contributed markedly to fire spread. These incidents indicate incomplete engineering of processes from a fire safety viewpoint.

4. Construction weaknesses were evident in almost all of the large loss fires. Only 3 of these worst industrial losses occurred in fire-resistive structures while 97 occurred in partially or wholly combustible buildings and 5 in noncombustible structures. While the construction details at Livonia were not exactly duplicated in these records, similar fire experiences in like structures are a matter of record in other years.

5. Welding sparks were the cause of four large loss industrial fires in addition to the Livonia fire. Losses from these four fires totalled $1,886,000.

6. Lack of an effective private fire brigade was noted in 16 other incidents where it was judged that had a brigade been available or properly trained, effective work to limit the spread of fire could have been possible.

7. Delayed fire department notification was recurrent in 18 per cent of the 105 fires.

Each of the seven separate factors described above were listed in the NFPA report as being the principal items responsible for the General Motors fire. As is evident, the statement might be broadened to indicate that these same factors are among the principal contributing factors found in our studies of all the serious manufacturing plant fire losses of 1953.

Public Fire Protection

Study of the industrial fire experience also reveals some other startling facts. Livonia was a community of about 17,000 people at the time of the General Motors fire. Their fire department was a part paid and part volunteer department with a skilled chief. This is reasonable protection for such a community consisting principally of dwellings, but of course, even with their preplanned mutual aid, they were not suitably equipped to handle a fire involving 34.5 acres under one roof. It is interesting to note, while not being at all critical of similarly organized and equipped fire departments, that 58 of the 105 fires occurred in towns of under

*Previous highs were 99 in 1951, 92 in 1948, and 88 in 1952.

†See NFPA Quarterly for October 1953 and NFPA Pamphlet Q47-2, 25 cents.

tection was installed at the time of the fire. For full details, see October 1953 NFPA Quarterly or NFPA Pamphlet No. Q47-2 (25 cents per copy). See also, page 251 of this Quarterly.

20,000 population or in areas outside city limits. This is an abnormally high percentage which seems to be mounting each year. It emphasizes the need for particularly complete private protection in manufacturing establishments located in essentially suburban communities having fire defenses not keyed to industrial plant protection requirements.

Exposed Buildings

In one third of these large fires the flames communicated to structures other than the ones initially involved, mostly because of inferior combustible construction, inadequate space separation, interconnecting passageways or conveyors, plain glass windows or poorly constructed party walls.

Sprinklered Buildings

There were 12 cases where large losses were sustained in industrial plants protected by complete automatic sprinkler systems. In one of these, the fire at Republic Aviation in Farmingdale, New York on Dec. 7, the sprinklers operated efficiently, confined the fire to the place of origin and prevented all but minor damage to the building. The large loss was occasioned by the high value of the single aircraft destroyed following a jet fuel explosion.

In 4 cases, explosions damaged sprinkler systems to render them ineffective. This was true in the American Polymer plastic plant in Peabody, Mass., Apr. 30, the Standard Paint and Varnish plant in Windsor, Ont., May 7, the Armstrong Cork linoleum plant in Lancaster, Pa., Jan. 14, and the C. A. Lund ski manufacturing plant in North St. Paul, Minn. In 3 cases, at Leigh Textile in Fall River, Jan. 21, at Kingan Company, Indianapolis, Nov. 13, and at Southern Cotton Oil in Huntsville, Ala., Dec. 27, the occupancy hazards were judged too severe for the type of sprinkler system installed. Unsupervised valves that were closed when the fire occurred prevented water from reaching sprinklers at the Rochlin Veneer and Plywood Plant in Statesville, N. C., on July 20 and the Superb Oak Flooring Co. plant in Whelen Springs, Ark., on Nov. 6. Insufficient water supplies prevented effective sprinkler operation at the Anchor Toy Corp., property in Coudersport, Pa., on July 28th and high piling of stock prevented effective distribution of sprinkler water in the property of Stein Brothers Paper Box Co. in Chicago on December 16.

As noted above, 5 of the large loss fires occurred in plants having partial sprinkler coverage and in each instance, the fires originated outside the areas protected. From such situations we can only observe that attempting to guess the place of origin of an industrial plant fire and protecting only this portion of the plant is a hazardous practice.

Detection

Fifty-nine per cent of the large industrial fires occurred during non-operating periods and in 58 per cent, detection of the fire was delayed, repeating previous experience.

In 64 per cent no watchman service was available where needed. Last year the figure was 66 2/3 per cent. In 40 per cent of the cases, the fires were first noticed by outsiders or passersby. Last year the figure was 33 per cent.

In seven cases, complete automatic detection equipment was provided and despite the fact that in each case the systems operated to give the alarm, large losses resulted. This is the worst experience for plants so equipped accumulated to date in our yearly large loss fire studies. It is further complicated by the fact that in all cases, the automatic detection equipment was supervised by central station systems (5 cases) or was provided with direct fire department connections (2 cases). All seven installations were identified as rate-of-rise systems and were believed to have been installed according to existing technical standards. This experience would seem to indicate the need for more careful engineering of the types of detection equipment and protection applicable to individual properties.

Batteries

Weekly Review Publishing Co.

Nov. 29, Conshohocken, Pa. The wood roof was the means of fire spread through this 15,000 sq. ft. unsprinklered plant.

Nov. 29, Conshohocken, Pa. C. & D. Batteries, Inc. $250,000.

Storage batteries. Fire discovered by the substitute watchman at 1:17 A.M. (at about the same time it was seen by outsiders) spread along the wood roof and destroyed 70 per cent of the 15,000 sq. ft. unsprinklered 1-story brick, wood-joisted building. The fire originated in the charging room where 500 batteries were on charge. A fire wall with protected openings is credited with saving the shipping and casting departments that occupied 30 per cent of the floor space. Fences and mud delayed locating pumpers near enough to a canal to draft water.

Ceramics

July 27, Antioch, Ill. No sprinklers and weak water supplies from hydrants handicapped control of this pottery plant fire.

July 27, Antioch, Ill. Regal China Co. $904,000.

Pottery. Lack of automatic sprinklers, inadequate water supplies from hydrants on a dead-end 6-inch main, and unprotected openings in division walls were factors responsible for destruction of the large-area 1-story masonry, wood-joisted plant. The fire originated in the packing department where it was discovered by an employee at 9:30 P.M. Volunteer firemen were on the scene within five minutes but despite their efforts fire spread rapidly through unprotected openings and along the roof. Mutual aid calls brought a total of 14 pumpers but only two of these could be used because of the weak water supplies from hydrants.

Chemical Plants

United Press Photo

Feb. 21, Newark, N. J. A laboratory explosion, fatal to 2 occupants, occurred in the Nitroform plant in Newark.

***Feb. 21, Newark, N. J. Nitroform Products Co., Inc. $600,000, 2 Killed.**

Tetranitromethane; plastic finish; cotton wadding. A violent explosion in the second story of a 2-story brick, steel-framed building killed the only occupants of the building, wrecked the section of the building where the explosion occurred and severely damaged parts of two adjoining and communicating 2-story buildings. Sprinkler piping in the three sections was badly damaged but fortunately no fire ensued. The explosion occurred in a laboratory in which tetranitromethane (an oxidizing agent) was made by adding acetic anhydride to anhydrous nitric acid in a cooled, steel mixing tank. Possible causes of the blast were explosion of either of the explosive intermediate compounds acetyl nitrate or diacetylorthonitric acid, due to rise in temperature of the reaction, or explosive decomposition of acetyl nitrate by catalytic action of iron oxide from the stainless steel tank.

Mar. 28, Webster Groves, Mo. Petrolite Corp. $380,500.

Oil refining chemicals. During a nonoperating period, and 45 minutes after the watchman had passed through the building,

*Explosion damaged other structures.

a violent explosion demolished the 1,290 sq. ft. 2-story brick, wood-joisted building containing equipment for reaction of organic oxides. Apparently the explosion was caused by ignition of vapors of flammable liquid leaking from a pipe line. Nonexplosion-proof electrical equipment may have been the ignition source.

***Sept. 23, Town of Tonawanda, N. Y. Lucidol Division of Novadel-Agene Corp. $550,000†, 11 Killed.**

Benzoyl peroxide and other organic peroxides. Four violent explosions at 25-minute intervals leveled the 1-story, brick, wood-joisted plant, demolished twelve dwellings in a nearby housing project and badly damaged several others. Twenty-seven persons were injured. The deaths of all occupants of the building and the complete destruction of the plant prevented determination of the probable cause of the blasts.

Dec. 2, Goodland, Ind. Judson Dunaway Corp. $383,000.

Mfg., blending, packaging drain and toilet bowl cleaners. Delayed discovery was once again the reason for total destruction of an industrial plant. In this instance, no watchman or automatic protection was provided and stock was piled against windows preventing chance discovery of fire by passersby until seen coming through the roof by an outsider at 1:15 A.M. It was immediately apparent to fire officials that the 35,000 sq. ft., mostly 1-story brick, wood-joisted building was beyond saving and that assistance would be needed to save wooden sheds of a lumber yard separated from the chemical plant by a 16-ft. wide alley. Despite nauseating fumes from the burning chemicals firemen saved the lumber yard and eventually extinguished the fire with heavy stream devices. Fumes damaged paint, chrome and hardware on automobiles and dwellings in the neighborhood.

*Explosions damaged other structures.
†Includes business interruption loss.

Food Products—Bakery

***June 21, Hugo, Okla. Butternut Baking Co., Inc., et al. $250,000, 1 Killed.**

Bakery; offices; grocery store, lodge hall. One of the two occupants of the bakery was killed and the other was seriously injured in a gas explosion and ensuing fire that destroyed

Associated Press Wirephoto

Sept. 23, Town of Tonawanda, N. Y. One of the major disasters of the year occurred at the Lucidol Division of Novadel-Agene Corp. Eleven were killed and 27 injured. Note the close proximity of housing developments to the chemical plant which was producing benzoyl peroxide and other hazardous peroxides.

Palmer Tate

Feb. 17, Chestertown, Md. Destruction was almost complete in this 101,800 sq. ft. building which lacked subdivisions or sprinklers. Discovering the fire at 2:00 A. M. the watchman called the plant manager and then the volunteer fire department but fire control was virtually impossible because of weak water supplies for hose streams.

Wm. L. Morgan, Box 174, Monterey, Calif.

Oct. 24, Monterey, Calif. Fire department response resulted from an automatic detection system alarm but firemen could see flames coming through the roof while four blocks from the scene. No explanation for the apparently delayed alarm from the automatic system is available but other similar large loss fires with rate-of-rise equipment perhaps indicate the need for further engineering appraisals of the suitability of this type of equipment for protection of certain occupancies.

the 8,800 sq. ft. 2-story bakery building. Cause of the explosion at 3:10 A.M. was undetermined. Flames spread to two exposed buildings through plain glass windows.

Food Products—Canneries

Jan. 27, Osceola, Ark. Mississippi Valley Canning Co. $320,000.

Fruits, vegetable processing and storage. Due to delayed discovery fire had involved two-thirds of this undivided 23,290 sq. ft. building when the first hose streams were placed in operation. The wood-frame, metal-clad building was unsprinklered and was not protected by a watchman,

***Feb. 13, Andersonville, Ga. Easterlin Packing Co. $250,000.**

Fruit and vegetable canning, storage. Fire of unknown cause that broke out during the lunch hour destroyed the 1-story wood-frame, metalclad cannery and an adjacent warehouse. The plant was located in an area without public fire protection. Firemen responded with one pumper from Americus, 12 miles away, but were helpless after exhausting the 5,000 gallon water tank on the premises.

Feb. 17, Chestertown, Md. Vita Food Products, Inc. $500,000.

Vegetable and fish pickling, packing. Combustible construction without subdivisions or sprinkler protection, lack of an adequate public water supply and an unfavorable wind combined to cause almost complete destruction of the 1- and 2-story 101,800 sq. ft. building. On discovering the fire in the cannery section at 2:00 A.M., ten minutes after reportedly visiting that area on a regular tour, the watchman first called the plant manager and then called the volunteer fire department. By the time apparatus had arrived, wind-driven fire had involved most of the second story and was burning down to the first story.

Oct. 24, Monterey, Calif. Sea Beach Packing Co., et al. $250,000.

Fish processing. Two adjoining canneries, half over water, were destroyed by a suspicious fire that originated in a second floor can loft and was beyond control when apparatus responded to an alarm transmitted at 3:48 P.M. by a fire department connected rate-of-rise, spot type automatic detection system. Firemen could see flames and smoke coming from the roof while still four blocks from the scene. Fire spread to the adjoining wooden cannery since the concrete wall that separated the two buildings extended only 100 ft. along the 230-ft. common boundary. A third adjoining cannery was saved by a concrete fire wall that extended the full length of the building on the exposed side. Hose streams protected a hotel separated from the building of origin by an 11-ft.-wide alley.

Nov. 11, Terre Haute, Ind. Campbell Soup Co. $615,000.†

Baked bean canning. Apparently originating in one of two trucks containing waste paper and parked in the loading dock over the holiday, fire spread rapidly beyond control following discovery almost simultaneously by the plant watchman and the central station supervised automatic detection system. Contents of the unsprinklered, undivided 31,000 sq. ft. brick, heavy timber building and the building itself were severely damaged.

*Fire spread to other structures.

†Includes business interruption loss.

Chas. A. Meyer

Feb. 13, Andersonville, Ga. This fruit and vegetable cannery was located outside public protection. Private protection was totally inadequate.

Wide World Photos

Dec. 26, Los Angeles, Calif. A watchman on duty in this plant on a Saturday afternoon about 4 P. M. did not report the fire. A passing truck driver gave the first alarm and the blaze was beyond control on arrival of fire equipment.

Dec. 26, Los Angeles, Calif. Diamond Walnut Co. $433,000.

Walnut canning. The watchman who supposedly made hourly rounds of the unsprinklered, 1-story wooden building did not discover the fire that destroyed the structure. Detection was delayed until the fire was seen by a passing truck driver at 4:13 P.M. (Saturday) when it was beyond control.

Apr. 5, Macon, Ga. Borden Co. $271,000.

Milk, ice cream, cold storage lockers. Firemen, summoned by employees at 2:53 A.M. for fire that originated in a storage room, were confronted by fire that had already burned through the roof when they arrived. Efforts to save part of the unsprinklered 1-story brick, wood-joisted building proved futile as firemen were forced out by ammonia gas released from refrigerating equipment.

Food Products—Flour, Feed Mills

***Mar. 25, Gretna, Va. Galveston Mills, Inc. $450,000.**

Feed mill, grain elevator. Flames were coming through the roof of the unprotected 2-story brick, wood-joisted milling building when first noticed by a passerby at 7:30 P.M. By then, flames were spreading throughout the undivided building and soon jumped to the almost adjoining grain elevator. Effective use of the limited number of hose streams available saved an exposed flour mill.

*Fire spread to other structures.

Apr. 30, Clyde, N. Y. Clyde Milling Corp. $280,000.

Dairy and poultry feed. At 4:20 A.M., less than 30 minutes after the last member of the night shift went home, an explosion (presumably fire gases) called the attention of a passing policeman to fire that seemed to involve at least a third of the 3-story wooden mill. Fire spread rapidly through the undivided, unsprinklered and dusty building.

May 11, New Orleans, La. J. T. Gibbons, Inc. $1,236,000.†

Stock feed milling, mixing, storage. The importance of several fundamental principles of fire protection was confirmed by fire that burned out one of four sections of a 3-, 5-, and 7-story fire-resistive building. The need for automatic protection and watchman service was emphasized by the fact that the fire was only discovered when the watchman of another plant 500 ft. away looked over and noticed smoke coming from fifth story windows. When firemen arrived flames were visible on the second through fifth stories of the 6,725 sq. ft. 5-story section at one end of the building. Fire doors that had not already closed automatically in the two nearest sections were closed by firemen with the exception of two that were blocked open by stock. Fortunately these two doors were remote from the fire although air undoubtedly fed the fire through these openings. All other doors performed their function of confining the fire to the

†Includes business interruption loss.

G. E. Arnold

May 11, New Orleans, La. Features of structures which are often overlooked were significant in this fire. Fire doors, unprotected belt openings and inadequate floor drains played an important part in confining, on the one hand, and extending, on the other hand, the spread of fire in this feed plant of J. T. Gibbons, Inc.

section of origin, and the only entrance to the adjoining section was through two unprotected 12 inch by 18 inch openings at the fifth story level. Firefighters were able to confine damage to a few bags of grain in the adjoining section. The fire originated on the second floor and spread upward through several unprotected belt and conveyor openings and wooden elevator legs and was not brought under control until after five hours of fire fighting with twenty 2½-inch and 1½-inch hose lines. Floor drains were inadequate to carry off the water and since curbs had not been provided and stock was not skidded heavy water damage resulted.

June 26, nr. Kalona, Iowa Yoder Feed Mill $250,000.

Feed mill. No private or public protection spelled destruction of this 5,000 sq. ft. 4-story wooden mill. Fire was beyond control when noticed by a passerby at 11:30 P.M. and flames were coming from the roof when fire department tank trucks arrived from Kalona. 6½ miles away. Each tank truck had 550 gals. of water. They protected exposures.

***June 28, Hamilton, Texas Hamilton Mill and Elevator Co. $400,000.**

Feed mill, two warehouses, elevator. Spontaneous heating of ground feed was given as the probable cause of fire that originated in the first story stock room of the 3-story wood-frame metalclad mill and warehouse building. With no automatic protection or watchman

*Fire spread to other structures.

June 28, Hamilton, Texas. A feed mill, two warehouses and an elevator were destroyed by fire as delayed detection in the unprotected plant allowed flames to spread beyond control.

to detect fire when small, discovery was not made until flames had spread out of control and were seen by a passerby at 9:30 A.M. (Sunday). Communicating combustible buildings were also soon involved.

***Nov. 27, St. Joseph, Mo. Dannen Mills $267,000.**

Elevator, two mill buildings. A welding torch being used to make repairs in the fifth story of the unsprinklered 5-story brick, wood-joisted building was the probable cause of fire that destroyed the elevator and two adjoining brick, wood-joisted buildings. The fire broke out at about 8:30 P.M. while the welding crew was at lunch. On discovering the blaze, they attempted to control it with several first aid extinguishers and the alarm was not transmitted until a gasoline station attendant saw flames coming from fourth and fifth story windows. When the elevator collapsed an adjacent 2-story building caught fire.

Food Products—Packing Houses

Sept. 11, nr. Whittier, Calif. Henny Penny Egg Co., et al. $400,000.

Egg candling and packing; bottle, machinery and furniture storage. Substandard watchman protection which did not require regular rounds and permitted the watchman to sleep after midnight allowed fire to make great headway before discovery by an outsider at 5:07 A.M. The first apparatus to arrive found the undivided and unsprinklered 42,000 sq. ft. wooden building in flames. A few minutes later the roof caved in. The watchman's screams were heard in time to permit his rescue through a window.

Nov. 13, Indianapolis, Ind. Kingan and Co. $315,000.

Meat processing. Fire originating in waxed paper piled several feet high in the seventh story of the 7-story brick, wood-joisted building entered a hollow wooden partition before it could be completely extinguished by sprinklers. Flames spread within the wall to the joist channels between the wooden ceiling and the roof, eventually burning off the roof. Since the fire was burning above the seventh story ceiling out of range of sprinklers a ladder pipe, and a monitor nozzle permanently mounted on the roof of an adjacent building, were used to put out the roof fire. The fire department did an effective job with this equipment in confining the fire to the roof of the building of origin although handicapped by delayed notification of the fire by the central station supervising the plant fire protection. The plant rather than the public fire department was notified on receipt of alarms from a private fire alarm box and from the sprinkler system waterflow alarm. Much of the loss was caused by water damage to meat being processed under controlled temperature and humidity on the top floor of an adjoining building.

Nov. 23, Springfield, Mo. Union Stockyards $350,000.

Hay and cattle barns, stock pens. Delayed transmission of the alarm and poor condition of fire hose were the principal factors responsible for destruction of 163,231 sq. ft. of the stockyards and death of 260 cattle. On discovering the fire in a wooden hay barn at approximately 1:30 P.M. employees fought the blaze with first aid extinguishers and garden hoses before calling the fire department. Wind drove flames into the adjacent stock pens where they were eventually controlled with twelve 2½-inch and four 1½-inch lines. Bursting of 16 sections of 2½-inch hose severely hampered fire fighting operations.

Leather Working

Aug. 2, Fairfield, Pa. Fairfield Shoe Co. $500,000.

Women's leather and imitation leather shoes. Fire that apparently originated with an explosion in the dust collection system just after the watchman made his hourly inspection, spread rapidly over the combustible fibreboard ceiling and wall finish. (Dusts generated in the plant were wood, leather and plastic.) Flames were beyond control in the undivided and unsprinklered 28,125 sq. ft. 1-story, wood-frame, metal-clad building when firemen arrived. Lack of water was a severe handicap to fire fighters.

Linoleum Plant

Jan. 14, Lancaster, Pa. Armstrong Cork Co. $650,000†, 1 Killed.

Linoleum manufacturing. Partial roof collapse of a 60-ft.-high 1-story building, 198 ft. by 370 ft., following a rumbling sound, best described as "continuous thunder," trapped two workers, one of whom lost his life. The second worker miraculously escaped by crawling out from under the debris despite severe injuries. The large, high building was of masonry construction with a concrete on steel deck roof and brick

*Fire spread to other structures.

†Includes business interruption loss.

walls. It was subdivided by brick walls into 26 stoves, mostly used for curing linoleum. Each stove was 12 to 14 feet wide, 198 feet long and 60 feet high and each was sprinklered. At 5:03 A.M. men at work in the area were on their way out, walking on a catwalk some 36 feet above the stove floors. Several witnesses reported having seen jets of smoke, vapor or dust coming through cracks in the wall between stoves 2 and 3, others reported a burst of orange and blue flame. All described a simultaneous dull, sustained rumble following which the roof structure over several of the stoves collapsed. Small fires broke out after the collapse but all were handled by the plant fire department and the city fire department was not needed.

Metal Working

Jan. 16, Asbury Park, N. J. Trad Television Co. $370,000.

Electronic equipment. Absence of watchman and automatic protection allowed fire to spread beyond control in the undivided 1-story masonry, steel-joisted building before discovery by a neighbor at 4:22 A.M. The fire reportedly stopped production of highly specialized and classified electronic equipment for the armed services. All records in light metal filing cabinets were lost.

***Feb. 14, Paterson, N. J. Wire Corporation of America $400,000.**

Coated wire for television receivers; dwellings. Failure to maintain sprinkler protection (apparently discontinued several years ago) was a vital factor in the destruction of the 2-story masonry, wood-joisted plant and 10 dwellings on the opposite side of the street. When discovered by a passer-by at 2:02 P.M. (Saturday), fire was beyond control in the building of origin and had reached such proportions when firemen arrived they were unable to prevent spread.

Feb. 20, nr. Emporia, Va. Refrigeration Engineering Corp. $400,000.

Walk-in lockers and other refrigeration equipment. Fire originating in or near a glue press and discovered by the watchman at 2:15 A.M. destroyed the unsprinklered and undivided 1-story masonry, wood-joisted building, primarily because of lack of water for fire fighting. Firemen from Emporia, 1 mile away, drafted a small well at the site dry in three minutes.

March 8, So. Milwaukee, Wisc. Food Machinery and Chemical Corp. $1,000,000.

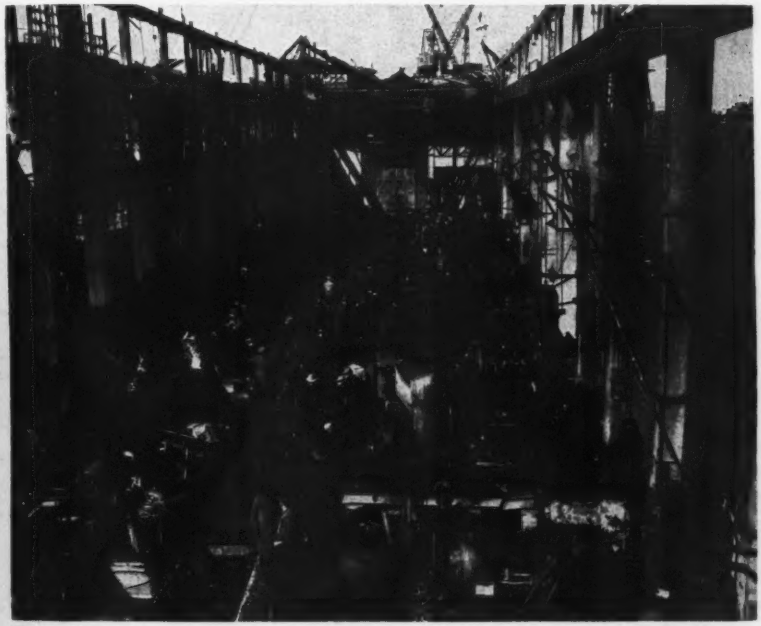
Power-driven rotary tillers. Failure to provide a substitute watchman for the regular night watchman, who was sick, left

*Fire spread to other structures.

World Wide Photo

Feb. 14, Paterson, N. J. Flames spread across the street to damage 10 dwellings opposite the Wire Corp. of America plant. Sprinkler protection had been discontinued for several years prior to the fire.

Mar. 8, So. Milwaukee, Wisc. The regular watchman was sick. No substitute was provided. A passerby discovered this fire at 12:45 A. M. and the loss in this unsprinklered property was $1,000,000.



Halifax Fire Dept.

Mar. 11, Halifax, N. S. Sprinkler protection in this Halifax shipyard machine shop was ineffective as the fire originated in an unsprinklered wood hose drying tower attached and flames spread over a combustible roof collapsing sprinkler piping.

the plant without protection on the night that fire broke out. The unsprinklered and undivided 15,625 sq. ft. 2-story brick, wood-joisted manufacturing building was in flames when noticed by a passerby at 12:45 A.M.

Mar. 11, Halifax, N. S. Halifax Shipyards, Ltd. $415,000.

Machine shop, hose drying tower. A sprinklered machine shop was heavily damaged when a mysterious fire originated in an attached unsprinklered wood hose drying tower and spread into the shop for lack of fire wall cut-off and because of a combustible roof. Combustible exterior sheathing on the walls of the shop and ordinary glass in wood frames contributed to the spread of fire. Sprinkler pipe hangers let go as the roof collapsed rendering the overtaxed sprinklers totally ineffective. Fire department hose streams covered all four sides of the building and 3 lines were used inside to extinguish fallen roof timbers and keep heat from damaging machinery. Four turrets and one monitor were directed at the roof section to try to restrict flame spread. Seven lines were taken from the shipyard pump supplying salt water. Night shift employees fought the fire with hand extinguishers between 2:05 and 2:16 when one of them pulled the fire alarm box at the Shipyard's gate office. The sprinkler system was not tied into the alarm system and had no fire department connections.

Apr. 16, Chicago, Ill. Haber Corp. $342,000, 35 Killed.

Assembling deep fat fryers, including processing aluminum castings. Thirty-five persons were killed and 38 injured in fire that originated in the first story and quickly involved the 4-story brick, wood-joisted building. Inadequate exit facilities, responsible for the casualties, consisted of a stairway that emptied into the first story, and a fire escape exposed by windows. The fire originated in an exhaust duct from a sanding machine when a sanding belt being used on aluminum casting became disengaged causing a shower of sparks that entered the duct. A flash fire and a series of dust explosions in the duct were followed by a burst of fire from duct openings that quickly enveloped the first story. Employees in the first story fled safely but black smoke consisting of incompletely vaporized mineral spirits from wash tanks spread up the stairway, mixed with air and ignited causing a flash fire that

Wide World Photo

April 16, Chicago, Ill. The largest loss of life in any industrial plant fire during 1953 occurred at this Haber Corp. metalworking shop when 35 employees were killed. Inadequate exit facilities were cited in the detailed report above.

involved the entire building in minutes. With the only stairway choked with heat and smoke and the outside fire escape undoubtedly impassable because of flames and smoke bursting from windows, employees on upper floors had no safe means of escape. (See July 1953, *Quarterly*, pp. 61-64)

***Apr. 22, Alexandria, Va. Temple Foundry $305,000.**

Iron foundry. Loss of wooden patterns, hand carved to exceedingly fine tolerances, accounted for $250,000 of the total loss caused by this fire. Ignition of wooden columns by sparks from a melting furnace was the probable cause. Employees fought the fire with soda-acid extinguishers and did not immediately call the fire department. The fire got out of control and spread to three interconnected 1- and 3-story buildings.

May 11, No. Baton Rouge, La. Ethyl Corp. $2,367,500.†

Lead-sodium alloy. Following repair of a rotary drum caster on the mezzanine between the second and third floors, mineral seal oil was reintroduced into the cooling system of the caster by a pump located outside the 3-story masonry, steel-framed building. Through a mistake, oil was introduced at too high a pressure, and escaped as a spray from around a leather seal. Ignition source was probably electrical equipment. Burning oil burned through rubber connections on cooling oil lines to other nearby machines resulting in an intense oil-fed fire that warped unprotected steel framing, caused the steel-framed, concrete deck roof to collapse, and damaged machinery. The fire was extinguished with approximately 2,500 lbs. of dry chemical powder and 1,000 lbs. of dry soda ash. The dry chemical was discharged from one 1,000 lb. extinguisher, two 350 lb. extinguishers and ten 20 lb. extinguishers The soda ash was applied by hand.

May 15, Clinton, Mich. Clinton Machine Co. $500,000.

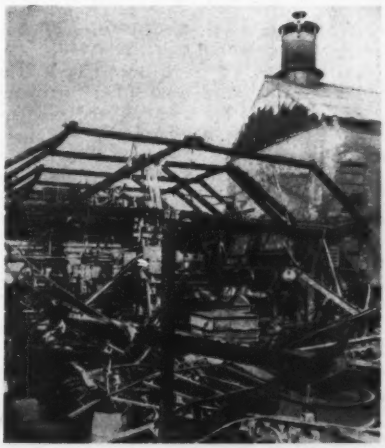
Chain saws. At 11:30 P.M., while on his first tour of the plant, the watchman discovered fire in the welding and painting area. The fire had reached such magnitude that the watchman could not re-enter the building after giving the alarm, and the fire was beyond control in the unsprinklered 2-story brick, wood-joisted building when firemen arrived.

May 15, Alexander City, Ala. Russell Pipe and Foundry Co. $400,000.

Iron pipe and fittings. The undivided 88,436 sq. ft., 1-story wooden building containing the foundry, milling department and cupola room was destroyed by fire that had involved a large part of the roof in the foundry when discovered by the watchman at 8:40 P.M. Fire spread beneath the roof the length of the building before apparatus arrived. Cause of the fire was unknown.

May 18, Delphos, Ohio Gramm Trailer Corp. $1,715,000.†

Trailers. Another illustration of the fallacy of permitting large fire areas to exist without strong automatic protection was given by fire that destroyed the unsprinklered and undivided 1- and 2-story masonry, steel-framed building, having a ground floor area of 110,000 sq. ft. The only protection for the plant during nonoperating periods was a watchman who made rounds at irregular periods. He was in the gate house at 6:00 A.M. when an explosion called his attention to fire that by then had filled the building with smoke and damaged telephone wires. Spread was so rapid that fire fighters were primarily concerned with saving exposures. The fire apparently originated in a wooden office building over and around which an addition to the factory had been constructed.



June 4, Elkhart, Ind. An overheated gas-fired core oven ignited roof timbers of this undivided and unsprinklered 40,000 sq. ft. 1-story iron foundry.

*Fire spread to other structures.
†Includes business interruption loss.

June 4, Elkhart, Ind. Elkhart Iron Works $250,000.

Iron foundry. Ignition of roof timbers by heat from an overheated gas-fired core oven was the reported cause of fire that destroyed all but the cupola section of the undivided and unsprinklered 40,000 sq. ft. 1-story brick, wood-joisted and wooden building. Apparatus responded promptly to an employee's alarm but flames had already broken through the roof and were spreading laterally. Although the lack of sprinkler protection and fire divisions were the most important contributing factors, temporary shutdown of part of the city's water supply system prevented maximum use of all pumpers at the scene. On the day of the fire the 500,000 gal. supplementary reservoir tank had been drained to permit repairs to the riser.

June 6, Los Angeles, Calif. Neco. Inc., et al. $300,000.

Screw machine products; bathing suit storage. On a Saturday afternoon, about an hour after the shop had closed, several persons in the neighborhood noticed smoke coming from the building and telephoned the alarm. By then the fire had made considerable headway in the undivided 11,700 sq. ft. 1-story masonry-walled building and part of the roof fell in soon after apparatus arrived. Despite the extent of fire when firemen arrived, they managed to save part of the building and an adjacent exposure.

***June 13, Vancouver, B. C. Vancouver Engineering Works Ltd. $250,000.**

Transformers. Fire discovered by a central-station-supervised rate-of-rise detection system destroyed the unsprinklered and undivided 15,000 sq. ft. 1-story wood-frame, metalclad building. Fire caused moderate damage to two adjoining and communicating buildings before being controlled by fire department hose streams. Although the cause of the fire could not be determined with certainty, overheating of an electrically heated "pitch" tank due to failure of the thermostat was a possibility.

June 20, nr. Niles, Ohio Youngstown Steel Car Corp. $505,000.†

Steel plate fabricating. Two employees working overtime discovered fire at 12:15 A.M. that destroyed the undivided 37,380 sq. ft. 1-story masonry, wood-joisted building. Private protection, consisting of a watchman and yard hydrants, was seriously inadequate as indicated by failure of the watchman to discover the fire and inability of yard hydrants on a long dead end main from the city limits to supply enough water for firemen to prevent fire from spreading along the roof. Firemen were also hampered by exploding acetylene and oxygen cylinders.

June 24, Chicago, Ill. W. J. Dennis Co. $256,000.

Metal weather stripping. Lack of subdivisions and automatic and watchman protection was responsible for extensive damage to the 12,500 sq. ft. 1-story brick, wood-joisted building. Originating in the rear of the first story shortly after all employees left for their annual vacation, fire burned undetected until seen by a passerby.

June 27, St. John, Mich. Saylor-Beall Co. $500,000.

Sprayers, compressors, miscellaneous metal equipment. The 56,000 sq. ft. 1-story masonry, wood-joisted building was destroyed by fire that originated in the undivided 18-inch-high concealed space between the ceiling and roof. No watchman or automatic protection was provided and consequently fire was not discovered until 9:21 P.M. when a neighbor's attention was attracted by a flickering electric light on the plant grounds. Firemen had extinguished a small fire in the first story (apparently caused by sparks that had dropped through the ceiling) when the roof space fire was observed.

July 2, New Philadelphia, Ohio Cummins Diesel Corp. $270,000.

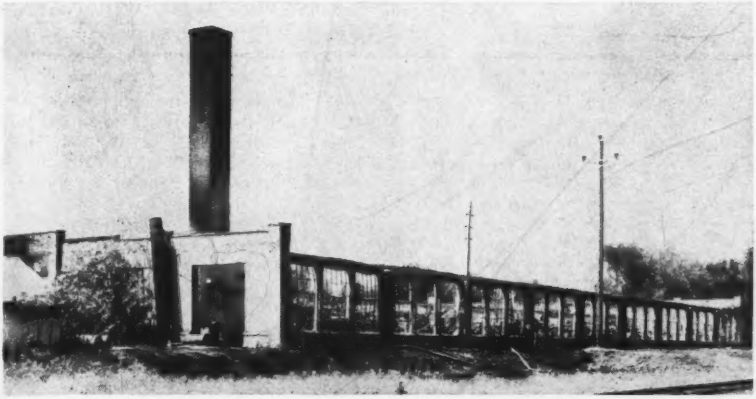
Diesel engine reconditioning and repair. Flames were coming through the roof and had involved all of the interior of the 10,000 sq. ft. 2-story wooden building when discovered by neighbors at 9:29 P.M. The building was undivided and had no watchman or automatic protection.

July 9, Saginaw Twp., Mich. Universal Metal Fabricators, Inc. $300,000.

Milk coolers, farm wash tanks, and other sheet metal products. Many obvious weaknesses in fire protection for this large-area 1-story wooden plant combined to cause its destruction. The building was located outside the city limits and a considerable distance from the nearest fire department, yet had no major fire protection. The boiler room where the fire originated was not cut off from the rest of the plant. Employees on discovery of the fire fought it with several extinguishers before notifying the Saginaw Fire Department.

*Fire spread to other structures.

†Includes business interruption loss.



June 27, St. John, Mich. An undivided 18-inch concealed space between the ceiling and roof of this 1-story masonry, wood-joisted building of the Saylor-Beall Co. harbored a fire which went undetected until noticed by a neighbor at 9:21 P. M.

July 9, Gordon River, B. C. Western Forest Industries Ltd. $460,000.

Logging camp machine shop, warehouse and office. At 8:45 P.M., seven hours after carpenters renovating the 2-story wooden building had stopped work, an employee at the camp saw smoke and flames issuing from the roof. Fire apparatus responded promptly but fire was already beyond control in the 8,250 sq. ft. building.

July 17, Batavia, Ill. Lindgren Foundry Co. $1,041,000.

Pattern storage for iron foundry. Core boxes and valuable patterns stored in the 12,000 sq. ft. metalclad warehouse were destroyed because of flagrant violations of safe storage principles. Oily core boxes and shellacked patterns were stored to within two inches of the ceiling and blocked every window of the unsprinklered building, thereby preventing hose streams from reaching the interior of the building. The plant was in operation when the fire broke out but since no one had occasion to enter the warehouse building, discovery was delayed.

***Aug. 5, Windham, Me. Baker Refrigeration Co. $499,500.**

Commercial refrigerating machinery. Two buildings were practically destroyed and five were partially damaged in fire that is believed to have originated in the unsprinklered basement of an otherwise sprinklered 1-story brick, wood-joisted building. Since the building had no watchman protection the fire was not discovered until it was simultaneously evident to several neighbors. (A sprinkler alarm that had been heard ringing for some time was mistaken for a railroad crossing bell.) Fire had involved the first story when firemen arrived and the poor single source supply for sprinklers was depleted as soon as pumpers connected to hydrants. No pumper pumped into the sprinkler system. Fire spread into an adjoining partially sprinklered 2-story brick, wood-joisted building through a fire wall opening, the automatic fire door for which was blocked open, and since no water was now available for sprinklers, flames spread throughout the building. An adjoining 2-story fire-resistive building suffered partial damage from fire that entered through a blocked open door, and roofs of two other buildings were damaged by a falling wall.

Aug. 12, Livonia, Mich. General Motors Corp. $55,000,000, 6 Killed.

Automobile automatic transmissions; gun range finders. In the largest industrial fire loss on record three employees were trapped and killed, 15 were injured, a member of the Livonia Fire Department suffered a fatal heart attack, and two members of a construction crew were electrocuted while clearing debris several days later. Fire protection weaknesses that combined to cause this disastrous fire were:

1. An undivided fire area of 1,502,500 sq. ft. (34.5 acres), in which absence of fire

*Fire spread to other structures.

walls and roof vents denied access for fire fighting and prevented localization of heat and smoke.

2. Inadequate sprinkler protection (only 20 per cent of the total area protected—no sprinklers where the fire started).

3. Incompletely engineered processes. Fire protection for the dip tank did not protect the drip pan. Due to the processes, oily deposits had a tendency to accumulate and increase the fire hazard of the several heat-treating areas, yet this condition does not appear to have received engineering attention.

4. Unprotected steel construction, in particular the thin steel deck that did not offer sufficient insulation between banking heat and the built-up roof covering to prevent asphalt from melting and dripping through joints of the heat-warped deck. Steel trusses collapsed in a matter of minutes.

5. Use of oxy-acetylene torch under unsafe conditions.

6. Lack of an effective private fire brigade.

7. Delayed fire department notification.

A detailed report of the fire is published in the October, 1953 *Quarterly*, pp 105-120.

Sept. 9, Walla Walla, Wash. Washington State Penitentiary. $300,000.

License plate mfg. on prison grounds. Fire believed set by prison inmates was beyond control in the undivided and unsprinklered 45,000 sq. ft. 1-story brick, wood-joisted building when Walla Walla apparatus arrived. A private fire brigade of convicts used 2½-inch lines on the fire without effect.

Sept. 26, Granville Island, B. C. Wright's Canadian Ropes Ltd. $480,500.

Wire rope. Substandard watchman protection that limited patrols to outside the building was a serious fire protection weakness that resulted in total destruction of the undivided and unsprinklered 87,500 sq. ft. 1- and 2-story wooden building. The fire originated in a locker room and had burned an estimated 12 hours before discovery.

***Oct. 31, Anaconda, Mont. Al's Body Shop, et al. $500,000.**

Auto body shop; auto sales and service, funeral home, laundry, lodge hall. A violent

*Fire spread to other structures.

Detroit Free Press

Aug. 12, Livonia, Mich. The flat roof at the General Motors Plant had much to do with the spread of fire. Photo shows part of the warped roof deck through which melted tar and asphalt in the covering dripped and added fuel to the fire.

Oct. 31, Anaconda, Mont. This fire was preceded by an explosion in a 1-story wooden auto body shop. The ensuing fire spread into the adjacent 2-story brick, wood-joisted building shown in the photo through plain glass windows.

explosion at 1:30 A.M. as the proprietor of the body shop was locking up to go home wrecked the 1-story wooden building. By the time apparatus was on the scene fire had entered an adjacent unsprinklered 2-story brick, wood-joisted building through plain glass windows and was spreading rapidly through the undivided structure. A lodge hall adjacent to the building of origin was also destroyed by fire and many buildings in the neighborhood suffered broken windows from the force of the blast. Cause of the explosion was not reported. The building was used for paint spraying and contained an acetylene generator.

Nov. 3, Mendon, Mich. Mendon Co. $500,000.

Automotive coils. One hundred and ten employees were thrown out of work when fire destroyed the 1-story combustible building where they were normally employed. The fire was discovered at 10:30 P.M. by one of six employees in the plant and originated at the loading dock where knocked-down boxes were stored. Fire extinguishers and a 1½-inch hose were used by employees until apparatus arrived. Hose streams supplied by pumpers had the fire under control until the 6-inch main went dry. By the time pumpers could be relocated at a river the fire was again out of hand and was not extinguished until the building was a total loss.

Nov. 11, Escanaba, Mich. Northern Motor Rebuilding Co. $250,000.

Automobile motor rebuilding. Lack of watchman and automatic protection delayed detection of fire in this 18,000 sq. ft. 1-story masonry, wood-joisted building until seen by a motorist at 5:42 A.M. By then the fire was beyond control in the undivided structure. The fire is believed to have originated at roof level in the vicinity of an exhaust duct from a spray booth and may have been preceded by fire in the duct. Flames spread laterally through channels formed by joists, the wood roof deck and combustible fibreboard interior finish for the roof.

Dec. 7, Farmingdale, L. I., N. Y. Republic Aviation Corp $750,000, 1 Killed.

Aircraft manufacturing. While running fuel calibration tests on a jet powered aircraft on a production line, a flash fire, followed by two fuel tank explosions, resulted in the death of one mechanic and injured nine others. Automatic sprinklers (five heads operating) controlled the fire so that damage to the structure was negligible and effective work by fire brigade members with two standpipe hose streams (equipped with spray nozzles), nineteen 15-pound CO_2 extinguishers, nine 2½-gallon foam extinguishers, six 2½-gallon water type extinguishers and one 20-pound dry chemical unit extinguished the aircraft fire. It is presumed that an electrical

spark from the energized aircraft system ignited a mixture of JP-1 and JP-4 fuel vapors which were trapped in the fuselage due to spillage when a fuel line was disconnected prior to installing a redesigned line. The loss figure is damage to the aircraft.

Dec. 29, Los Angeles, Calif. Maletron Corp. $450,000.

Hydraulic switches. Fire of undetermined cause that originated in a laboratory on the first floor of the unsprinklered 15,000 sq. ft. 2-story brick, wood-joisted building had made considerable headway before discovery by the plant watchman at 7:04 P.M. Detailed reports were not yet available.

Mining—Coal

Jan. 8, Yancey, Ky. Harlan Fuel Co., Inc. $510,000.†

Tipple, conveyor, head house, bin at bituminous coal mine. Oily coal dust residue near the oil spraying operation was ignited by an oxy-acetylene welding torch being used to make repairs on an upper level of the combustible tipple. Fire spread with great rapidity over dust in the vicinity and flaming dust particles dropped through floor openings and set fires at lower levels. First aid extinguishers were of no avail and by the time apparatus arrived from Harlan, fire had spread up within a combustible conveyor enclosure to the combustible head house and involved a new wooden coal bin. Water pumped from a creek by Harlan fire fighters prevented spread to buildings adjoining the tipple. Most of the storage bin was saved by employees using water from an abandoned mine.

June 2, nr. War, W. V. Jacobs Fork Pocahontas Coal Co. $506,500.†

Tipple at bituminous coal mine. A short circuit in the boom hoist motor of a loading boom caused fire that traveled down the oil-soaked steel cable used to move the boom. The oil spray station (coal was sprayed with high flash point oil), canvas spray hood and oil-soaked timber ignited and soon flames were spreading so rapidly up through the metalclad tipple that workmen had to flee. During the half hour required for apparatus to respond from the nearest town 10 miles away, fire practically destroyed the tipple and consequently every effort was made to save the 200-ft.-long metalclad conveyor carrying coal from the head house to the tipple.

†Includes business interruption loss.

The rubber conveyor belt was cut, but the weight of coal prevented the men from separating the two pieces sufficiently to stop fire from jumping from one to another. The fire in the conveyor was finally extinguished with first aid equipment and hose streams after about 75 ft. had been involved.

***Oct. 11, nr. Bellevue, Alta. Coleman Collieries. $305,000.**

Coal tipple. Fire that was out of control in the tipple when discovered in the early morning leveled the tipple and damaged a part of the cleaning plant. Several smaller buildings in the vicinity were also damaged. No watchman protection was provided for the tipple during non-operating periods.

Dec. 7, Cardinal, Ky. Kentucky Cardinal Coal Co. $250,000.

Coal tipple and washing plant. The large wooden building and all equipment were destroyed by fire that was beyond control when the Harlan Fire Department answered an outsider's alarm at 2:30 A.M. The mine had not been in operation for two days prior to the fire and apparently no one had been in the tipple during that time.

Mining—Metal

June 7, Red Mountain, Colo. Idarado Mining Co. $500,000.

Copper mine surface buildings. Mine surface buildings and several snow sheds, one 900 ft. long, were destroyed by fire that originated at a track switch where employees were using a torch to cut a rail. Diesel oil in the track ballast ignited, fire spread into wooden snow sheds through which fire extended to various surface buildings. Water for fire fighting was lost when the main broke. Dynamiting of the snow shed leading from the machine shop to the crushing plant is credited with preventing involvement of the crushing plant.

June 15, nr. Henderson, Nev. Manganese, Inc. $1,264,000.†

Manganese ore refinery. Lack of automatic sprinklers and a trained fire brigade permitted fire to spread beyond control before apparatus arrived from Henderson, 6½ miles away. The fire was discovered at roof level in the 17,600 sq. ft., high 1-story wooden building (leaching, pulping, floating, rod mill) by employees at 11:55 P.M., 20 minutes after the watchman had passed through the temporarily shut down building.

*Fire spread to other buildings.

May 7, Windsor, Ont. Explosion of vapors of solvent escaping through a leaking gasket on a lacquer mill blew out the walls of the building of origin, damaged fire doors in fire walls, wrecked sprinkler piping and started this fire.

Paint and Lacquer

***May 7, Windsor, Ont. Standard Paint and Varnish Co. Ltd. $750,000.**

Lacquer, paint. An explosion of solvent vapors and ensuing fire destroyed eight adjoining and communicating 1- and 2-story brick, wood-joisted buildings and severely damaged a detached building. The vapors were released from a lacquer mill in a mixing room. A leaking gasket had been observed but the cover on the water-cooled mill could not be tightened. Thirty minutes later the gasket "blew" and showered the room with highly volatile solvent. Fortunately the two employees on duty at the time (2:40 A.M.) were forced from the building by the vapors before a minor explosion, followed by a violent explosion, blew out the walls of the building of origin, damaged fire doors in division walls between buildings, wrecked sprinkler piping and started fire that spread throughout the adjoining buildings. A gas-fired hot water heater in the adjoining not-cut-off machine room was the probable ignition source.

Sept. 4, Union, N. J. Titanine, Inc. $400,000.†

Paint, lacquer. Ignition of vapors escaping from vats of flammable liquids in the mixing room was the probable cause of a flash fire that destroyed the unsprinklered 3,200 sq. ft. mixing room of the 1-story brick, wood-joisted building. All employees in the mixing room escaped safely and the action of one of them in closing the fire door in the fire wall between the mixing room and main plant area is credited with preventing further spread of fire. It is theorized that excessively hot weather on the day of the fire had caused an unusually large concentration of vapors to accumulate.

*Fire spread to other buildings.
†Includes business interruption loss.

Paper Products

Jan. 24, Philadelphia, Pa. Connelly Container Corp. $2,657,000.

Paper boxes. The unpardonable fire protection sin of permitting approximately six acres of undivided floor space in a box factory was the principal reason that fire destroyed the partially sprinklered 1-story fire-resistive building. The original building, representing about one third of the total area, was sprinklered but two new communicating additions used for roll paper storage were not protected. The fire was first discovered in one of these unsprinklered areas by the watchman at 4:40 A.M. as he completed his hourly round. Fire spread rapidly over the 900-lb. rolls of paper stored 9 to 12 rolls high and, when apparatus arrived, had gone through unprotected openings to all parts of the undivided building overpowering sprinklers in the sprinklered area. The fire department's effort to confine the fire to the building of

United Press Photo

Jan. 24, Philadelphia, Pa. Destruction of this building was another example of what may be expected in large-area buildings with partial sprinkler protection. Fire originating in an unsprinklered area spread rapidly to all the undivided 6-acre building.

origin was sucessful although hampered by a poor public water supply. Investigation revealed that the fire had probably been caused by ignition of gasoline leaking from a T-connection in the adjoining property of a petroleum products distributor. A total of 4,000 gallons of gasoline had been lost between Jan. 20 and Jan. 22.

May 23, Stockport Center, N. Y. Stockport Paper Co. $486,500.

Wrapping paper. Static spark ignition of vapors from kerosene used to wash calender rolls on an ungrounded paper machine was the probable cause of fire that destroyed the 1- and 2-story brick, wood-joisted paper machine and beater room building and an adjoining open sided shed under which 400 bales of waste paper were stored. Fire spread so rapidly over paper dust and other combustible materials that the employee operating the machine was almost trapped and could not complete his call to the fire department from the second story office because of heat and smoke. Flames were coming from windows when apparatus from surrounding towns arrived, and were being driven by a stiff wind into the waste paper storage shed. A large, wooden building 45 ft. from the mill, in which finished paper was stored, was spared by the favorable direction of the wind.

Following destruction of the mill by fire in 1911 its replacement was equipped with sprinklers. However, during a temporary shutdown in 1934 the sprinkler system had been shut off and had not been turned on.

Aug. 7, Brooklyn, N. Y. Phillips Paper Products, Inc. $394,000.

Misc. paper products. Originating in the center of the 60,000 sq. ft. 2-story brick, wood-joisted building, fire was coming through the roof when seen by an outsider at 12:34 A.M. No watchman, sprinkler protection or standard division walls were provided for the structure.

Oct. 20, Louisville, Ky. General Box Co., Inc. $1,050,000.

Corrugated paper and boxes. Several fire protection weaknesses combined to cause destruction of the 50,275 sq. ft. 1-story, mostly noncombustible building. No fire walls were provided, the building was unsprinklered, a large pile of corrugated paper scrap had accumulated near a new slot-punching machine that had not as yet been connected to the plant blower system, and interior structural members were covered with paper dust and lint. The fire originated in the pile of refuse near the slot-punching machine just after most employees had left for the night shift lunch period, and although discovered promptly by an employee and a fire-department-connected rate-of-rise type automatic detection system, extended up a wooden door to the under surface of the roof. Soda-acid extinguishers used by employees had no effect on the fast spreading fire. Flames raced through the dust accumulation on structural members and the under surface of the roof deck and had involved most of the building when apparatus arrived.

Oct. 23, Savannah, Ga. Chemical Packing Corp. $376,000.

Paper bags. Sparks from a welding torch being used in the construction of an addition were believed responsible for fire that destroyed the unsprinklered 20,000 sq. ft. 1-story wood-frame, metalclad building. Occupants used several foam, soda-acid and carbon dioxide extinguishers but were un-

able to prevent the fire from spreading throughout the building and involving large piles of paper stock. A 1,000 gpm electric fire pump furnished water for hydrant streams until the 6-inch main burst (after 1½ hours of pumping). Loss of water for 20 minutes while the break was mended was not an important factor since the building was beyond saving early in the fire.

Dec. 16, Chicago, Ill. Stein Bros. Paper Box Co., et al. $350,000.

Paper box set up and storage; fire door mfg., window display mfg. One-third of the roof and top story of the sprinklered 3-story brick, wood-joisted building were destroyed by fire because improper stock piling prevented sprinkler discharge from reaching the fire. The fire originated from an unknown cause in the middle of three fire divisions in the top story and was detected at 2:40 P.M. when employees in another part of the building heard the local waterflow alarm on the sprinkler system.

The fire department was called at once but due to high piling of set up paper boxes sprinkler discharge could not reach the flames and consequently fire was beyond control when apparatus arrived. The wood roof over the section of origin was soon involved and eventually collapsed. Fire doors closed automatically to prevent fire from spreading laterally to sections on either side.

Plastics

Apr. 30, Peabody, Mass. American Polymer Corp. $390,000, 1 Killed.

Plastics manufacturing. One of two employees supervising polymerization of vinyl acetate in a 750 gal. reactor was killed when a violent explosion wrecked the sprinklered 2-story masonry, steel-framed building housing the reactor. On noticing a gradual increase in pressure in the reactor the employees attempted to control the reaction by cooling, but without success; they were fleeing the building when flanges and glass observation ports on the reactor broke, releasing acetone vapors into the building. Ignition of the acetone vapor-air mixture caused the violent explosion. Investigation revealed that the reactor was equipped with a rupture disc vented to the outside but that the disc was rated to rupture at 175 psi instead of 75 psi. Had the proper disc been installed it is probable that the pressure would have been safely vented to the outside.

Courier-Journal and Louisville Times

Oct. 20, Louisville, Ky. Fire in this paper box factory originated in a large pile of corrugated paper scrap and spread rapidly through dust that had accumulated on structural members and the under surface of the roof. The 50,275 sq. ft. building was undivided and unsprinklered.

Associated Press Wirephoto

Apr. 30, Peabody, Mass. Explosion damage to four sprinkler systems is reported in the large loss fire record of manufacturing plants in 1953. The American Polymer Corp. plastic plant shown in this photo was wrecked when an acetone vapor-air mixture was ignited. One employee was killed.

Printing Plants

***Apr. 19, Blanchester, Ohio Brown Publishing Co., et al. $253,000.**

Printing, lodge hall; repair garage. The unsprinklered 2-story masonry, wood-joisted building of origin was heavily damaged and an adjacent 1-story wooden garage was destroyed by fire that originated in lodge rooms above the printing plant. The fire was discovered at 11:57 P.M. by an employee who was working late on the first floor. Before the alarm could be telephoned part of the ceiling came down setting fire to paper stacked in the bindery and forcing the employee to flee. The second story was totally involved by then, and flames spread rapidly through unprotected openings in a division wall from the bindery to the composing and press room. A narrow alley was inadequate exposure protection for the adjacent garage.

Apr. 19, San Diego, Calif. Arts and Crafts Press, et al. $271,500, 1 Killed.

Printing shop, restaurant, store. All of the 1-story section of the 20,000 sq. ft. brick building and part of the small 2-story section were destroyed by fire that was discovered by a passerby on Sunday afternoon. Origin was in or adjacent to a storage closet in the press room. The passerby pulled the lever on a fire alarm box, and then returned to the fire, not realizing that he had not pulled the lever far enough to trip the alarm mechanism. Flames spread rapidly through the 1-story section as he waited, and when apparatus failed to respond, he again pulled the lever, this time transmitting an alarm. When apparatus arrived flames were coming from the roof of the 1-story section and efforts were directed toward saving the 2-story section and adjoining buildings. The roof of the 1-story section was destroyed, part of the 2-story section was damaged and the hollow concrete block wall that formed part of an exterior wall was severely damaged. A 16-inch brick party wall protected an adjoining building and was intact after the fire. A fire department officer suffered a fatal heart attack during the fire.

*Fire spread to other buildings.

Refineries—Petroleum

***Jan. 28, Mercury, Alta. Gas and Oil Refineries Ltd. $300,000, 1 Killed.**

Four buildings, 32 storage tanks. Five men were burned, one fatally, by an explosion of vapors from gasoline escaping from a broken pipeline in an area where natural gasoline was stored in tanks under pressure. The broken pipe had been shut off but in

the absence of wind there was no way to disperse the vapors that flowed downgrade to a furnace 400 ft. away and ignited. The furnace fire had been put out when the leak first occurred but the bricks were still hot. Fire flashed back to the pressure storage area. Three pressure tanks exploded spreading fire to an adjacent diked area containing 18 gasoline storage tanks. In addition to the damage to tanks, two buildings in the path of the vapor drift were damaged by the explosion when the vapors ignited, and two buildings in the diked area were destroyed by fire. Fear that pressure tanks would explode prevented close approach to the fire for six hours, after which foam was used.

***Apr. 28, Montreal, Que. Canadian Oil Co. Ltd. $2,405,000.†**

Lube oil blending; grease compounding, and storage. Two adjoining and communicating unsprinklered buildings, one a rectangular heavy timber, 1-story oil blending building of 13,300 sq. ft. area, and the other an L-shaped reinforced concrete 3-story building of 28,500 sq. ft. area, were almost totally destroyed by fire that apparently originated in the laboratory on the first floor of the oil blending building. The plant had closed for the night but had been inspected by the watchman and by the plant engineer within 30 minutes of discovery of the fire by an outsider at 6:18 P.M. Fire, that was most intense in the vicinity of the laboratory when apparatus arrived, was fed by large quantities of oils in blending and storage tanks and soon involved most of the building. Prompt action of employees in shutting valves at tanks in the yard prevented additional fuel from flowing into the fire area through broken piping. The several openings at the first floor level in the fire wall between the two buildings were protected by automatic fire doors. Wired glass windows were in the upper two stories of the 3-story building in the wall overlooking the 1-story building. It is believed that all doors closed properly but this could not be determined due to the eventual destruction of the wall. The exposure to the wired glass windows from the roof of the 1-story building was so severe that it is believed the flames passed the fire wall through the windows. (See photo below.)

***Oct. 6, Cornwallis, Man. Angelo Canadian Oils Ltd. $500,000.**

Oil refinery, pump house, control building, topping plant. Fire originating in the control building spread to the nearby pumphouse and topping plant before being brought under control by the private fire brigade using foam. Detailed reports on the fire are not available.

*Fire spread to other buildings.
†Includes business interruption loss.

Gazelle Printing Co. Ltd.

Apr. 28, Montreal, Que. Fire, originating in a laboratory of a one-story oil blending building of heavy timber construction spread into an adjoining and communicating 3-story reinforced concrete grease compounding building through severely exposed wired glass windows on the two upper floors of the latter structure. Very severe damage was done to the fire-resistive structure because of the heavy fire load.

Refineries—Vegetable Oils

June 7, Sioux Falls, S. D. Western Soybean Mill $466,500.

Soybean feed and oil processing. Fire originating about 11:00 P.M. on a Sunday night was not detected by a rate-of-rise detection system until about 11:23, according to Fire Department estimates. Investigation revealed that the fire originated in a concealed area behind a wood electrical switchboard panel. Rain water apparently entered the electrical ductwork which was not protected against this hazard despite the fact that the switchboard was built into an exterior wall opening. When the central station alarm was received five fire companies responded but the flames had gained so much of a head start that a major loss could not be prevented. Dusty conditions, unenclosed stairwells and machinery openings in all floors of the 3-story mill and the wood interior construction of the concrete walled structure were handicaps for fire fighters.

***Dec. 27, Huntsville, Ala. Southern Cotton and Oil Co. $250,000.**

Cottonseed oil; boiler house. Fire caused by a wiring fault at an electric motor flashed with almost explosive speed over oily lint on structural members to all parts of the undivided 20,000 sq. ft. 1-story wooden mill. Opening of all sprinklers simultaneously overtaxed the weak water supply and reduced sprinkler effectiveness to zero. Responding promptly to the watchman's telephone alarm, fire fighters found the building totally involved and part of the roof falling in. The adjoining and communicating boiler house was also destroyed but fire department hose streams and six sprinklers operating inside kept fire from entering a wooden warehouse across a railroad siding.

***Oct. 11, Sulphur Springs, Texas Sulphur Springs Cotton Oil Co. $355,000.**

Cottonseed delinting, hulling, storage; lint baling. At 2:30 A.M., 3½ hours after the last employee left the 16,000 sq. ft. wooden seed house No. 1, an employee in the nearby boiler room noticed that the seed house was in flames. Although he attempted to telephone the alarm at once there was, according to one report, a 15-minute delay in reaching the fire department due to ques-

*Fire spread to other structures.

W. C. Zapp

Mar. 14, Jersey City, N. J. The basement of this 4-story, brick tenant manufacturing building, where fire originated, was used for foam rubber shredding. The fire became so intense that the building collapsed.

tioning by the telephone operator as to whether or not there was a fire. With only two yard hydrants on a 4-inch main available there was little that the volunteer fire department could do with a fire of this magnitude and when a wall of the 40-ft.-high seed house No. 1 collapsed, the exposed side of adjacent seed house No. 2 was ignited. The roof of the 9,730 sq. ft. 1- and 2-story brick, wood-joisted oil mill building 30 ft. from seed house No. 1 was ignited by flying embers. Several brick walls divided this building but because of unprotected openings fire spread throughout the mill.

Rubber Working

Mar. 14, Jersey City, N. J. H. Muehlstein Co. $250,000.

Foam rubber shredding; clothing, box mfg. Fire originating in the sub-basement of the 4-story brick, heavy-timber constructed building was beyond control when noticed by a passerby at 12:28 A.M. The sub-basement was occupied for shredding foam rubber and had been in operation until 11:00 P.M. Fire spread up through open stair and elevator shafts to all stories and eventually caused walls to collapse. No sprinklers or watchman service were provided.

Topeka Daily Capital

Mar. 26, Topeka, Kans. Delayed fire department notification of fire in this tire recapping shop allowed flames to spread along the fibreboard ceiling and then throughout the 25,000 sq. ft. building.

Mar. 26, Topeka, Kans. Capital Super Service Store, et al. $371,500.

Tire recapping, 40-car public garage, household appliances, sporting goods store. The various occupancies in this 25,000 sq. ft. 1-story brick, wood-joisted building were under one management, accounting for the fact that the areas were interconnected by unprotected openings or separated by combustible fibreboard partitions. The building was unsprinklered and had no watchman protection during nonoperating periods. These fire protection weaknesses in conjunction with the combustible interior finish and roof construction and the storage of tires contributed to an intense fire that destroyed most of the building before being controlled.

The fire originated in the vicinity of a rubbish container and tiered tires in the recapping shop and was spreading along the combustible fibreboard ceiling when noticed by a garage employee at 7:23 P.M. Had the alarm been transmitted at once the fire department, using spray nozzles, could probably have kept the fire from communicating sections. However, there apparently was some delay as employees tried to remove automobiles and flames had involved a large number of rubber tires and had broken through the roof over the tire recapping area when apparatus arrived. Under the circumstances the fire department did commendable work in controlling the fire, relying primarily on 1½-inch lines equipped with spray nozzles. Fire probably could have been confined to the tire recapping area had new 1250 gpm pumpers equipped with large spray nozzles, on order but not delivered, been available.

May 6, Eureka, Calif. A second serious tire shop fire (see Topeka fire reported above) emphasizes the need for the best type of sprinkler protection in such properties.

May 6, Eureka, Calif. Firestone Tire and Rubber Co. $275,000.

Tire recapping. Ignition of tire retreading stock in the basement by hot sulfur dripping through the cracks in the first floor was the reported cause of fire that destroyed the 1-story wooden building. Among the contents destroyed were 12 tons of camelback retread stock, 2,500 passenger car tires, 500 truck tires and 300 to 400 casings. The fire broke out when hot sulfur being used to repair a tire recapping machine on the first floor dropped through a crack in the floor and landed on retread stock stored below. Heat and smoke prevented firemen from entering the basement, and, since no sprinkler protection was provided, fire soon had control of the entire building.

June 10, Jersey City, N. J. H. Muehlstein and Co. $360,000.

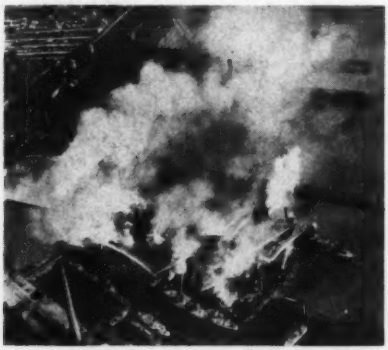
Rubber and plastics fabricating. A large-area undivided and unsprinklered 2-story building of mixed construction was destroyed by fire detected by a central-station-supervised rate-of-rise type automatic detection system at approximately 2:51 A.M. Operation of sprinklers is credited by officials with saving an adjoining 1-story brick building.

Shipyard

***Feb. 17, Baltimore, Md. Chesapeake Marine Railway Co., et al. $800,000.**

Four buildings, severe to total damage; two piers, severe damage; thirteen buildings, moderate to slight damage; yard machinery, shops, moderate to severe damage. Fire that destroyed or damaged this property originated on a marine railway where employees were using welding torches. Failure of an employee to operate a public fire alarm box properly (glass broken but lever not pulled) delayed fire department response until an alarm was telephoned 10 minutes later. By then flames, driven by a 35 mph gusty wind, had made considerable headway through the congested combustible buildings and piers. Wired glass prevented fire from entering all except one window on the exposed side of a sprinklered 5-story brick, wood-joisted building. When the window frame of a third story window was blown in, the fire was extinguished by one sprinkler.

*Fire spread to other buildings.



Feb. 17, Baltimore, Md. A welding torch was the probable cause of this fire that involved 17 buildings and two piers. Wired glass windows and inside sprinklers saved the 5-story building in left foreground.

Stone Cutting

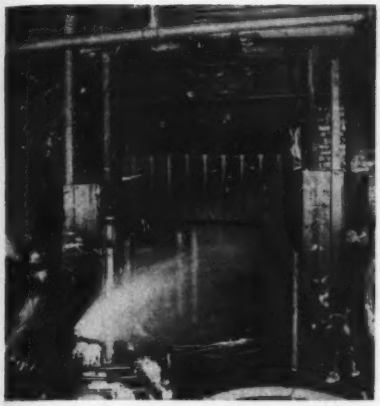
Sept. 10, Montreal, Que. Martineau Cut Stone Co. $293,000.

Stone cutting; truck garage. Two adjacent unsprinklered 1-story combustible buildings were destroyed by fire that was beyond control in both of them when apparatus arrived at 10:04 P.M. The fire originated in the 30,000 sq. ft. metalclad stone cutting building and was first noticed by the watchman of the garage.

Textile Working

***Jan. 21, Fall River, Mass. Leigh Textile Co. $450,000, 2 Killed.**

Cotton waste shredding, baling, storage. Two employees were killed and two were injured in a flash fire that destroyed two buildings and damaged a third, all equipped with sprinkler systems, but because of a poor water supply, the systems were not properly designed to protect against the type of fire that could be expected in this occupancy. The systems were fed by a private 6-inch dead-end main that left 16 psi on the top line of sprinklers with 500 gpm flowing. A spark caused by foreign material in stock going through a picker was the probable cause of the fire that flashed from the bottom of a 2-story storage bin with such explosive intensity that two employees were blown through an open shipping door to a truck outside, and two others removing stock from the bottom of the bin were fatally burned when their lint-covered clothing was ignited. At least 114 sprinklers in the three stories of the brick, wood-joisted building fused immediately, but from charring of the ceiling it was apparent that the water supply was overtaxed, being poor at some sprinklers and nonexistent at others.



Jan. 21, Fall River, Mass. Two employees removing shredded cotton waste from the bottom of a 2-story storage bin (shown in photo) were fatally burned when a flash fire burst from the bin.

Fire spread to the fourth story of an adjoining building because of an inoperative fire door, and but for fire department hose streams supplied from 12-inch public mains would probably have spread throughout this building. Here also, many sprinklers fused, but it was apparent that little if any water flowed. While fire fighters were concentrating on the fire in the building of origin and the adjoining exposure, sparks set fire to the penthouse of an adjacent sprinklered 2-story wooden building. No water was available for sprinklers, and by the time fire fighters were aware of the fire, the building could not be saved.

Answering the question, "Did the fire department pump into the sprinkler system?", no pumper connections were provided.

June 24, Roebling, N. J. Charlotte Coat Co. $350,000.

Coats. Absence of sprinklers or watchman protection allowed fire to make great headway in the undivided 1- and 2-story 22,500 sq. ft. masonry, wood-joisted building before being seen by neighbors at 2:32 A.M. Other fire safety weaknesses, attributed by the fire chief to lack of a Fire Prevention Code, were poor stock subdivision, blocked windows and generally bad housekeeping.

Aug. 4, Fort Worth, Texas Northwestern Compress Co. $811,000.

Compress and warehouse. The unsprinklered 37,500 sq. ft. section housing the compress and 4,553 bales of cotton was destroyed by fire that was coming from the compress tower when seen by the watchman at 8:34 P.M. The alarm was telephoned at once, but flames had flashed over the lint-covered interior before apparatus arrived. Fire walls with parapets and wings separated the fire section of the partially open-sided building from the sections on either side. In one case, however, wind-carried sparks went around the wing and ignited baled cotton, but fire fighters, on the scene with charged hose lines, were able to halt the spread.

***Nov. 13, Toronto, Ont. Toronto Dye and Finishing Co. $400,000.**

Dyeing, dress trimming, glass ornaments. Three buildings, unsprinklered and without watchman protection, were destroyed by fire that was beyond control in one of them when discovered by police at 2:18 A.M. The fire originated on the first floor and spread up an open elevator shaft to all stories of the unsprinklered 4-story brick, wood-joisted building. Fire doors left open in fire wall openings were the reported means by which fire spread to adjoining buildings.

Dec. 23, Thompsonville, Conn. Bigelow-Sanford Carpet Co. $330,000.†

Wool carpeting. Friction caused by a hot bearing on a fan shaft adjacent to two unsprinklered metal dryers in the top floor of the 3-story building caused fire that spread

*Fire spread to other buildings.
†Indicates business interruption loss.

Aug. 4, Fort Worth, Texas. Fire, when first seen by the watchman, was coming from the compress tower. Flames flashed over the lint-covered interior and eventually destroyed 4,553 bales of cotton.

Nov. 20, Radford, Va. One employee was killed, four were injured and $800,000 property damage was caused when a pressure cylinder used in creosoting railroad ties by impregnation ruptured while the cylinder was under air pressure.

over lint on equipment, belts and structural members in the vicinity and entered the unsprinklered dryers. The fire department was called at once and employees used several extinguishers to put out the lint fires but the hot fire in the dryer could not be extinguished until fire department hose streams were brought inside. In the meantime fire had spread through a ventilating stack that extended up through the wood roof monitor from one of the dryers. Due to inadequate clearance between the stack and roof, heat from the stack ignited the three-ply roll roofing. Flames spread along the upper surface of the roof, burning through slightly in places and opening sprinklers beneath the roof as it progressed. Approximately one-seventh of the roof of the 48,000 sq. ft. building was burned before the roof fire was extinguished with fire department hose streams. Water damage to finished carpeting, much of it unskidded, on lower floors accounted for a large part of the loss.

Wood Workers
Creosoting Plants

***Apr. 2, Texarkana, Texas International Creosoting and Construction Co. $1,293,000.†**

Creosoting ties, poles and bridge timbers. During a change of shifts when no one was on duty fire broke out in the 1-story wooden pump house and was coming from windows when seen by an employee. The private brigade and public fire departments were called and hose from roof hydrants on the exposed 23,000 sq. ft. 1-story wooden creosoting building were used to protect this structure until heat and smoke forced brigade members from the roof within 10 minutes. Fire, driven by a 16 mph wind, had entered the creosoting building before fire department hose streams were in operation and was being fed by creosote flowing from an outdoor storage tank into the fire through a broken pipe in the building. Due to the inacessibility of the valve this supply of fuel could not be shut off. Private and public hose streams were deprived of water 1¼ hours after the fire started when wires to the electric fire pump burned, and during the ½ hour while pumpers were relocated at a reservoir, supports under an 80,000 gal. working supply tank in the creosoting building collapsed spilling burning creosote that flowed into the adjacent yard setting fire to railroad rolling stock and a nearby machine shop.

Nov. 20, Radford, Va. Norfolk and Western Railroad. $800,000, 1 Killed.

Railroad tie treating plant. A pressure cylinder used for creosoting railroad ties by impregnation failed under air pressure and the blast killed one man (hit by flying debris), injured four others and caused a fire which did an estimated $800,000 damage, mostly to machinery and equipment. The technique used called for drying of the ties and then impregnating them with creosote. Air pressure was used to develop pressure in

*Fire spread to other buildings.
†Indicates business interruption loss.

the large creosoting cylinders which accommodated a special railroad car load of ties at a time. Just what caused the cylinder failure could not be determined but with air pressure as the medium the failure could have been either mechanical or due to ignition of the creosote and petroleum mixture in the cylinder. The building involved was a high, one-story tin and steel structure (see photograph, page 264).

Saw and Planing Mills

***Feb. 5, Bellamy, Ala. Allison Lumber Co., Inc. $250,000.**

Sawmill; fuel house. Ten minutes after the mill closed for the day, two employees still on the premises noticed fire in the vicinity of a steam engine used to drive a gang saw. By the time the plant fire brigade, summoned by the plant whistle, had 2½-inch hose streams in operation, fire had spread throughout the 12,760 sq. ft. undivided first story of the unsprinklered 3-story wooden mill and was extending to the second and third stories through belt holes and conveyors. The 750-gal. plant steam pump functioned until heat ignited the refuse conveyor between the fuel house and boiler house, stopping the fuel chain 15 minutes after the start of the fire. When the fuel under the boilers was consumed the fire pump stopped for lack of steam. Fire departments from two neighboring towns used water drafted from a lake to save surrounding buildings.

***June 4, Unadilla, Ga. Buff and Hodge Lumber Co., et al. $350,000.**

Saw and planing mill, seed processing and storage, cotton gin. Sparks from an unattended refuse burning area set fire to an unsprinklered planing mill 122 ft. away. Discovery was at 10:55 P.M. Wind-carried sparks from the burning mill ignited the wooden walls of a group of sprinklered wooden 1- and 2-story interconnected seed processing buildings 54 ft. away and a wooden peanut warehouse and elevator. Since weak fire department hose streams were unable to control the fire on the outsides of the sprinklered buildings and the fire was burning out of range of sprinklers, these buildings were soon beyond saving and sprinkler valves were closed to conserve water from city mains. Other exposed buildings, including a sprinklered cotton gin, were successfully protected by local and mutual aid fire departments, and at 3:00 A.M. apparatus from surrounding towns went home. At 3:25 A.M. the city water supply went dry (100,000 gal. elevated tank and 100,000 gal. reservoir) and local firemen returned to quarters. At 5:30 A.M. sparks ignited the cotton gin, and since no water was available for sprinklers or hose streams, it burned flat.

Aug. 30, nr. Wilson, N. C. Home Builders Supply Co. $400,000.

Saw mill, lumber yard. Fire originating in the mill had involved the mill and the 40,000 sq. ft. lumber yard when discovered by a passing motorist at 4:15 A.M. No automatic protection or watchman service was provided and the mill was beyond the city limits in an area where no contract had been made with the city for fire protection. As an accommodation, apparatus responded from Wilson but with a long dead end 6-inch main the only source of water, two 2½-inch lines were all that could be used.

***Oct. 25, nr. Sunbright, Tenn. Norman Lumber Co. $275,000.**

Planing mill. The mill, lumber sheds, office building and dry kiln were destroyed by fire that was set by sparks showering from an electric transformer on a post outside the mill. The watchman, on being advised of the fire by a passing truck driver, notified the fire department by steam whistle and started the steam pump to supply private hose streams. However, the steam pipe to the pump broke before hose streams could be placed in operation and fire spread beyond control before apparatus arrived.

Oct. 31, Wallowa, Ore. J. Herbert Bate Co. $350,000.

Planing mill. Sawdust and oil around machinery accelerated spread of fire through this unsprinklered and undivided 33,750 sq. ft. 1-story mill. Fire fighting was handicapped by a defective length of new hose and insufficient water caused by broken standpipes in the building. Absence of wind was the principal reason that fire was confined to the planing mill. Discovery was by the watchman at 4:35 A.M.

***Nov. 26, Corrigan, Texas Edens-Birch Lumber Co. $552,500.**

Planing mill, floor mill, dry kiln, three sheds, 1,500,000 board ft. lumber; dwelling. Twenty minutes after the plant watchman, according to his statement, went through the not operating planing mill and found everything in order, an employee in the adjacent

*Fire spread to other structures.

saw mill saw fire in the planing mill and gave the alarm. Delayed discovery in combination with congestion of wooden buildings (in most cases communicating), stacked lumber and shifting 25 mph winds spelled destruction of everything in the path of the fire with the exception of some stacked lumber hastily removed with a lift truck. Fire set by sparks destroyed a wooden dwelling across the street from the mill.

Miscellaneous Wood Workers

Feb. 18, Oklahoma City, Okla. Warr-Castion Lumber Co. $315,000.

Sash, doors, interior finish. Failure to keep vegetation from around walls of the unsprinklered 1- and 2-story wooden building allowed fire originating in grass at a nearby railroad siding to extend to and enter the building through cracks in the wall. Firemen summoned by a central-station-supervised automatic detection system and an alarm telephoned by an employee found fire beyond control in the undivided dusty 27,400 sq. ft. building.

***Mar. 21, New York (Queens), N. Y. Whitestone Wood Products Corp., et al. $275,000.**

Woodworker, sink tops. Three combustible buildings without automatic or watchman protection were destroyed by fire that was beyond control in two of them before arrival of apparatus and had spread to the third. Fire was discovered by a passerby at 2:29 A.M.

Apr. 7, Sharptown, Md. Marvil Package Co. $250,000.

Wooden baskets. An overheated bearing on an electric motor was the cause of fire that destroyed the unsprinklered 2-story wooden factory. The fire was discovered by employees and attacked with a carbon dioxide extinguisher but quickly extended to combustible contents. High winds that reached 50 mph at times accelerated and spread the fire beyond control in the undivided building.

July 20, Statesville, N. C. Rochlin Veneer and Plywood Co., Inc. $356,000.†

Veneer. Overheating of veneer in a steam heated all-metal dryer while the dryer was choked was probably responsible for fire that burst from the dryer and eventually destroyed the sprinklered 58,650 sq. ft. mostly 1-story wooden building. Sprinklers in the dryer were shut off for some unexplained reason (no one knew the valve was closed) and when heat and flame burst from the dryer a rapid spreading fire extended to all parts of the undivided building. Sprinkler protection was unable to cope with the fire because of a weak water supply from public mains and because the fire department did not pump into the system. No action had been taken on recommendations of underwriters' engineers to erect a fire wall and thereby reduce the area subject to destruction by a single fire.

July 28, Coudersport, Pa. Anchor Toy Corp. $1,000,000.

Wooden toys. Fire originating in the not-cut-off second floor finishing room spread so rapidly over combustible contents (shellacked toys, flammable finishes, etc.) that flames traveled right along in back of the employee who discovered the fire, as she ran for the stairs. All sprinklers in the undivided building (total area 66,576 sq. ft.) opened, overtaxing the single source water supply, a 6-inch low pressure main. No connections were provided through which the fire department could pump into the sprinkler system.

Nov 6, Whelen Springs, Ark. Superb Oak Flooring Co., Inc. $300,000.

Wood flooring mill. A sprinklered 1-story wood-frame, metalclad building housing the flooring mill, finished flooring warehouse and dry kilns was destroyed by fire discovered by the watchman about 20 minutes after he had completed his 3:00 A.M. round. His statement that he heard the sprinkler alarm outside the watchman's office ringing was refuted by the fact that the alarm was cut off and the alarm valve burned in the closed position. Instead of calling the fire department the watchman called the plant superintendent who in turn gave the alarm. When apparatus arrived, estimated at up to an hour after the fire was discovered, the building was beyond saving and the last of the water from the 100,000 gallon elevated tank was being discharged from the sprinklers. Since it was impossible to get the apparatus near enough to a pond to take suction, fire fighters could do little. At the time of the fire the mill was not in operation and contained almost no stock. The sprinkler system was new and had a good single source water supply. The only plausible explanation for inability of sprinklers to control the fire was that the system was shut off at the start of the fire and

*Fire spread to other structures.
†Includes business interruption loss.

Dec. 3, No. St. Paul, Minn. A wood dust explosion that wrecked some of the sprinkler piping preceded this fire that destroyed five adjoining and communicating buildings. The plant engineer was killed by the blast. It is surmised that while he was hand-firing the boiler with sawdust, a flash-back occurred that caused a dust explosion in the adjacent sawdust bin.

turned on after much of the building was involved. The watchman admitted closing the valve at the base of the sprinkler tank to drain the system on the day of the fire. The valve might not have been opened.

***Dec. 3, N. St. Paul, Minn. C. A. Lund Co. $500,000, 1 Killed.**

Skis, snowshoes, toboggans. A wood dust explosion killed the plant engineer, wrecked sprinkler piping and the boiler room roof, and caused fire that destroyed five adjoining and communicating 1- to 4-story buildings of mixed construction. The explosion occurred at 5:20 A.M., just after the engineer had come on duty to fire up the boiler for the day's work. Since the engineer was killed it can only be surmised that while he was hand-firing the boiler with sawdust, a flash back occurred that caused a dust explosion in the adjacent sawdust bin. Firemen summoned by a neighbor found part of the roof of the 1-story boiler room and sawdust bin blown off, dust collectors on the roof collapsed, and fire of considerable magnitude on the upper stories of two adjoining 4-story buildings. Fire had entered these buildings through windows broken by the explosion and overlooking the boiler room. Damage to sprinkler piping in the boiler room depleted all water for sprinklers. Flames spread unchecked through the interconnected buildings as fire fighters tried unsuccessfully to bring them under control with a poor water supply from a 4-inch city main.

*Fire spread to other structures.

Dec. 10, Eastview, Ont. Clairson Lumber Co., Ltd. $250,000.

Builders' supplies. The 10,000 sq. ft. undivided and unsprinklered 1- and 2-story wood-frame, metalclad building was destroyed by fire that broke out while 35 persons were in the building. The fire originated above the combustible fibreboard ceiling of the first story office and was not discovered until smoke filtered into the office. Further delay in fire department notification resulted when employees tried to fight the fire with first aid equipment. By the time an attempt was made to telephone the alarm, wires had burned. The alarm was finally telephoned from a neighbor's house but fire was so intense when apparatus arrived that firemen were unable to approach closer than 30 ft. to the building. Had they been called promptly, fire fighters believe they could have saved the building.

United Press Photo

March 9, Wilmington, N. C. Five one-story buildings were destroyed in this fire that originated in a 59,635 sq. ft. structure in which 25,000 tons of sodium nitrate were stored. Fire flashed through the dusty, dry and nitrate-impregnated building with such speed that all 900 sprinklers fused almost simultaneously. The intense fire soon spread to adjoining and adjacent buildings.

The 48 Largest Warehouse Fires of 1953

During 1953 there were 48 warehouse fires, each with a loss of more than $250,000. The aggregate loss was $41,458,000 or an average of $864,000 per fire. Five people were killed and 91 were injured. What were the factors responsible for these destructive fires?

First, it must be recognized that a warehouse by its very nature usually contains concentrated values and consequently, when fire occurs, values subject to damage per cubic foot of volume are in general considerably higher in warehouses than in any other occupancy. This being the case, what kind of protection was provided for the material stored in the 48 warehouses suffering large loss fires in 1953?

Construction-wise, none of the buildings was fire-resistive, so that in all cases a destructive fire could sweep through the building irrespective of the combustibility of the contents. Evidence that combustibility of the building was an important factor was the fact that seven fires involved buildings storing such noncombustible materials as tin cans, meters, sinks, sheet metal and sodium nitrate. In all of these the contents damage was much more, measured in dollars, than the building loss, yet contents did not burn.

Another vital factor of warehouse fire protection is area of storage space subject to destruction by a single fire. The largest reported ground floor area involved in the 48 fires was 145,500 sq. ft. and the average ground floor area was 34,500 sq. ft. In multi-storied buildings with unprotected openings between stories, the area subject to destruction by a single fire was increased by the upper floor areas.

As indicated, the contents of seven of the warehouses was predominantly noncombustible. The contents were combustible in the other 41 fires and in these an excessive quantity of stored material, as indicated by high piles, narrow aisles and blocked windows, was noted as contributing to fire spread. In four instances flammable liquids released from drums and cans ruptured by heat added fuel to the fire. In the warehouse used to store noncombustible sodium nitrate, the combustibility of the wooden structural members was greatly increased by the oxygen-giving nitrate.

In 34 of the 48 fires, delayed discovery and consequently delayed attack was a major factor influencing the extent of loss. In 40 cases neither automatic sprinklers nor automatic detection equipment was installed.

Four large loss fires with a total loss of $18,240,000 occurred in sprinklered warehouses. On March 9, at Wilmington, North Carolina, a $5,800,000 fire started in a sprinklered warehouse containing sodium nitrate. In this instance the hazard created by the presence of the strong oxidizing agent in contact with combustible structural members was too great to be controlled by the sprinkler system as installed. Incomplete sprinkler protection was a vital factor in a $10,000,000 fire at Whittier, Alaska, on June 17. The fire originated in an unsprinklered attic. On June 22, fire broke out in the rubble of a sprinklered rubber warehouse that had collapsed in Philadelphia because of overloading. Similarly, fire broke out in the remains of a sprinklered cotton warehouse at Vicksburg, Miss., after the building was wrecked by a tornado.

Central station and fire department connected automatic fire detection systems were installed in four of the 48 warehouses. The fires occurred in a cold storage warehouse at Pajaro, California, January 6; in a grocery warehouse at Baltimore, Maryland, February 14; a cosmetic warehouse at Hollywood, Calif., March 9; and a furniture warehouse at San Francisco, Calif., March 12. All four installations were supervised, rate-of-rise type automatic detection systems, two connected to a central station and two to fire department headquarters.

Builders' Supplies

***Jan. 21, Kansas City, Kans. Lumberman's Supply Co., et al. $503,000.**

Builders' supplies; sash and door manufacturing; terminal warehouse. A 1,000 ft. by 32 ft. 1- and 2-story wooden building separated by combustible partitions was destroyed by fire that was coming from the roof of the 2-story section (middle 500 ft. was two stories high) when noticed by an outsider at 7:30 P.M. The building was unsprinklered, had no watchman protection and all occupants had left for the night, accounting for the delayed discovery. Nevertheless, much of the undivided building could have been saved had there been sufficient water available to supply four hose lines early in the fire. Water was supplied through a 2,100-ft.-long dead end 6-inch main in which a 4-inch domestic type meter had been installed. Early attempts to get water for ladder pipes and deck guns failed when soft suction lines from hydrants collapsed and it was only by careful operation of pumpers that a limited amount of water for two hand lines could be obtained. In the face of this weak attack, fire burned unhampered in both directions throughout the undivided building. A 1-story metalclad warehouse 17 ft. away was damaged and 60 freight cars were damaged or destroyed.

Chemicals

Hollywood Citizen-News

March 9, Hollywood, Calif. While firemen were laying hose lines, fire flashed through fire gases beneath the roof.

Mar. 9, Hollywood, Calif. Max Factor and Co. $650,000.†

Cosmetics, cartons, plastic bottles. Fire of suspicious origin was confined to cartons in a 100 sq. ft. area in one corner of the 12,000 sq. ft. building when apparatus arrived on alarm transmitted by a central-station-supervised, rate-of-rise automatic detection system. While hose lines were being laid, the fire suddenly flashed through fire gases that had accumulated beneath the roof, forcing firemen from the building. With the entire wood roof of the undivided and unsprinklered brick, wood-joisted building in flames, it was impossible to prevent burnout of the interior and collapse of the roof. Dismissal of the case against the suspect was granted "for insufficient evidence."

***Mar. 9, Wilmington, N. C. Wilmington Terminal Whse. Co. $5,800,000,† 1 Killed.**

Four warehouses and one wharf shed containing 25,000 tons sodium nitrate, 200 tons fish meal, 4,421,529 lbs. tobacco in hogsheads, 1,000 rolls roofing paper, 275,000 paper bags, 400 cases canned goods, 4,500,000 lbs. sugar in paper bags. The limitations of private and public fire protection when confronted with fire involving bulk storage of sodium nitrate in a large-area combustible warehouse was demonstrated in this instance. Defective electric wiring was the probable cause of fire that originated near the roof monitor of the undivided 59,635 sq. ft. 1-story brick, wood-joisted building in which the nitrate was stored in large wooden bins. The fire was discovered promptly, sprinklers and private hose streams were soon operating but the fire spread very rapidly beneath the dusty and dry wooden roof. Flaming embers ignited the nitrate-impregnated wooden floor and partitions, forcing fire fighters to abandon inside hose lines. Fire soon communicated to the adjoining 34,860 sq. ft. sprinklered wharf shed through unprotected or poorly protected openings. A 55,000 sq. ft. sprinklered 1-story brick, wood-joisted warehouse in which tobacco, paper bags, roofing and canned goods were stored, was across a railroad siding from the nitrate building and in the path of wind-driven intense heat. All compartments of this building were soon in flames, after which fire jumped 50 ft. to an empty and unsprinklered 26,370 sq. ft. 1-story brick, wood-joisted building, then 40 ft. farther to an unsprinklered 1-story building in which sugar was stored. Spread to the next

*Fire spread to other structures.
†Includes business interruption loss.

warehouse in line was stopped by hose streams directed from a fireboat and two tug-fireboats stationed in the intervening 135-ft.-wide slip.

During the fire molten nitrate reached very high temperatures and explosions of water trapped in the nitrate (steam explosions) occurred with sufficient intensity to knock down the walls of the nitrate building. One civilian helping fire fighters was fatally burned by molten nitrate blown on him by one of the explosions.

Failure of sprinklers to check the fire in the sodium nitrate warehouse was due to the large number of sprinklers (900 in the building) that were opened almost simultaneously by fire intensified by oxygen released from the sodium nitrate. One report of the fire suggested that it may be impractical to design automatic protection with sufficient water supply to control a fire in a sodium nitrate storage building of this area and construction. This report further suggested that if sodium nitrate were stored in a completely noncombustible building with no exposure hazards, sprinkler protection would not be necessary since sodium nitrate is noncombustible. (See photo, p. 268)

Cotton

Dec. 5, Vicksburg, Miss. Union Compress and Warehouse Co. $725,000.

Baled Cotton. Tornado winds from the southwest accompanied by lightning, were responsible for this serious loss in a one-story cotton warehouse building on the south side of Vicksburg. Following destruction of three exterior walls and two fire walls by the wind, fire broke out in the remains of the 6,750 sq. ft. building, eventually destroying 4,000 bales of cotton. Lightning is believed to have been the direct cause of the fire. During the fire, plant buildings were without fire protection since one of two 100,000 gallon elevated tanks supplying sprinkler systems and yard mains toppled and ruptured the looped main. The undamaged tank quickly drained through the rupture. The city main was not connected to the yard system. The fire was originally confined to one of the three destroyed sections of the building and was practically extinguished by firemen drafting from a drainage ditch. However, fire spread out of control when firemen left to assist at another emergency caused by the tornado.

Herb Carleton

Sept. 9, Van Nuys, Calif. Television sets piled to the eaves and with improper aisles between piles were destroyed by fire discovered by an employee working in a partitioned-off testing area in the unsprinklered 10,000 sq. ft. building.

Electrical Equipment

April 25, Mobile, Ala. Graybar Electric Co. $615,000.

Household equipment, meters, transformers. During a severe electrical storm lightning struck the roof of the 14,000 sq. ft. 1-story brick, wood-joisted building loaded to capacity with crated electrical equipment. Although apparatus was summoned promptly by a passerby who saw the lightning strike, the interior of the undivided and unsprinklered building was totally involved when apparatus arrived. An unpierced, parapeted fire wall prevented spread to an adjoining 1-story warehouse.

Sept. 9, Van Nuys, Calif. Pacific Mercury Television Mfg. Corp. $637,000.

Television storage. At 1:10 A.M. an employee in the building checking electronic equipment in a small partitioned-off area smelled smoke coming from the storage area and ran from the building to telephone the alarm. However, the fire had already been seen by occupants of another building and the alarm transmitted. When firemen arrived almost the entire roof of the 10,000 sq. ft. unsprinklered 1-story masonry, wood-joisted building was in flames. Due to the congested storage of TV sets in cartons, which were piled to the eaves and with inadequate or no aisles, efforts to fight the fire from outside were practically impossible and the roof collapsed a short time later. Damage to the contents was practically total.

Fireworks

***June 5, Houston, Texas Alco Fireworks and Specialty Co., et al. $3,000,000, 4 Killed.**

Fireworks storage; 57 buildings wrecked or damaged. Four residents of an apartment house were killed, 83 persons were injured and a four-block area was wrecked by a series of explosions in a 1-story metal-clad warehouse containing an estimated 50,000 lbs. of fireworks. Fire that preceded the explosions started while an employee was assembling an elaborate fireworks display. The employee ran from the building before the explosions commenced. A dwelling a block away was set on fire by flying debris. Of the total damage, $165,500 was caused by fire. The rest of the loss was caused by explosion.

***June 19, nr. Ft. Worth, Texas Wilfong Fireworks and Specialties Co., Inc., et al. $264,000.**

Fireworks storage and distribution; 100 dwellings. Shortly after boys fired a BB gun into the 15,000 sq. ft. 1-story masonry, wood-joisted building, smoke was observed

*Fire spread to other structures.

June 5, Houston, Texas. Four persons were killed, 83 injured and 57 buildings were wrecked or damaged in a series of explosions in this warehouse containing 50,000 lbs. of fireworks.

coming from packages of fireworks in the shipping room. Fortunately all employees had time to flee the building before an explosion blew off the roof. The fireworks plant was demolished and about 100 dwellings were damaged by the explosion. Fire involved the wreckage of the fireworks building and ensuing explosions spread fire to exposed dwellings.

Food and Groceries

Jan. 6, Pajaro, Calif. California Berry Freezers, et al. $341,000.

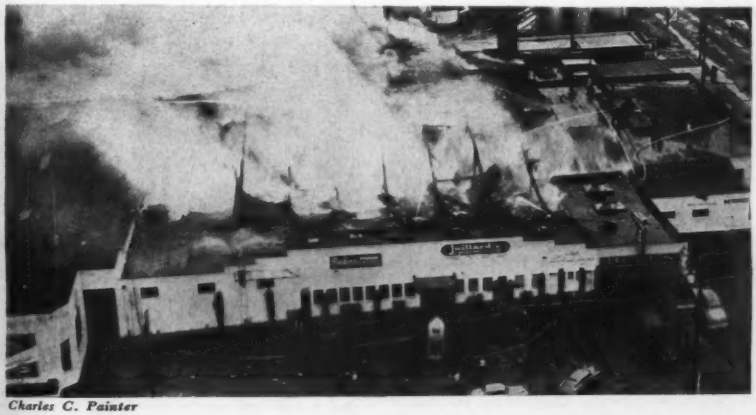
Berries, juices, canned apples, liquor. Prior to removal of refrigeration coils the coils were purged to remove ammonia. The purging was not complete, however, since after most of the pipe had been removed, a mild explosion occurred when the acetylene torch cut into a section of pipe. Fire was scattered about and could not be extinguished by workmen using extinguishers before they were driven from the cold storage room, leaving the door open behind them. Firemen, summoned by the supervised, rate-of-rise automatic detection system, had difficulty in locating the fire due to dense smoke and were handicapped by an inadequate water supply (700 gpm) which was further reduced early in the fire when the deep well pump supplying mains went out of service. Fire spread rapidly to the 34,475 sq. ft. main section of the unsprinklered 1-story masonry, wood-joisted building but was kept from several adjoining and communicating areas by fire doors, some of which were closed prior to the fire while others closed automatically during the fire.

Feb. 14, Baltimore, Md. The Great Atlantic and Pacific Tea Co. $525,000.

Groceries, egg candling, banana ripening. Lack of sprinklers allowed fire to destroy a large part of the undivided 3⅓-acre 1-story building. Twenty minutes after the watchman passed through the egg room a central-station-supervised, rate-of-rise automatic detection combination device gave the alarm for fire that was apparently confined to the egg room when apparatus arrived. However, the heavy stock of groceries, many combustible partitions, lack of hydrants on the side of the building nearest the fire and long distances to accessible hydrants delayed fire department attack until fire had burned through the combustible ceiling and was spreading through the space beneath the roof.

Mar. 12, Orillia, Ont. National Grocers Ltd. $400,000.

Grocery store warehouse. Lack of subdivisions, sprinkler and watchman protection allowed fire to destroy the heavily loaded 400-ft.-long 2-story masonry, wood-joisted building. Responding to an outsider's alarm shortly after 10:00 P.M. firemen found the building heavily charged with smoke and could hear fire burning within walls and beneath floors. Flames eventually broke into



Charles C. Painter

Jan. 6, Pajaro, Calif. While refrigeration piping was being dismantled with a cutting torch a mild explosion occurred involving ammonia gas remaining in the pipe. Fire was scattered about by the explosion and soon involved much of the building.

the open but barred windows and high-piled stock prevented effective use of hose streams.

April 18, Cleveland, Ohio Cook Coffee Co. $385,000.

Coffee, misc. food products. Reliance on substandard watchman service to assure prompt fire detection and control resulted in the almost total destruction of the unsprinklered and undivided 24,800 sq. ft. 1-story brick, wood-joisted building. The fire apparently originated at a ventilating fan in a room in the rear where signs were stored. It was beyond control when noticed by the watchman who made no regular rounds and was carrying out janitorial duties in the front of the building when he first smelled smoke.

Aug. 12, Memphis, Tenn. Wetter Warehouse Co., et al. $335,000.†

Groceries, miscellaneous storage. Absence of sprinkler protection (requested several times by the fire department and tenants) was primarily responsible for burn-out of the 1-story brick, wood-joisted building. The fire was discovered by an outsider at 8:28 P.M., about three hours after employees left, and originated in a section of the basement where a gas-heated gluepot was located. Dense smoke typical of many basement fires prevented effective fire-fighting (14 fire fighters were hospitalized despite the use of self-contained breathing equipment). Flames spread between floor joists out of range of hose streams and burned into the first story.

Aug. 25, Tulsa, Okla. C. V. Cox and Son $441,500.†

Retail grocery warehouse. The fortunate time of origin of fire in the masonry, steel-framed warehouse while the adjoining and communicating supermarket was still open permitted firemen, responding to a store clerk's alarm at 7:12 P.M., to arrive in time to save half the undivided, 43,000 sq. ft. warehouse. The heavily loaded warehouse was unsprinklered, no watchman was provided, and one of the three nonautomatic fire doors between the warehouse and store was open. Had the fire occurred during the night, it is probable that the entire warehouse would have been destroyed and the fire would have entered the adjoining supermarket.

Oct. 4, Edgewater, N. J. Cargill, Inc., et al. $650,500.†

Fish oil storage. Delayed fire department notification as the watchman tried to control fire with a foam generator cost firemen a chance to save part of the 29,000 sq. ft. 1-story wood-frame, metalclad building constructed partly over water. Flames were through the roof when firemen responded to an alarm from an outsider at 11:25 P.M.

Oct. 27, Starks, Wisc. Starks Potato Farms, Inc. $250,000.

110,000 bushels of seed potatoes. Muffled explosions at 7:00 P.M. called neighbors' attention to fire that was beyond control in the undivided and unprotected 10,800 sq. ft. 1-story wooden warehouse. The roof was falling in when apparatus arrived.

Oct. 29, Evansville, Ind. The Creasey Co., et al. $706,000.†

Groceries; small amount of misc. other materials. A person taken into custody in connection with another burglary in Evansville confessed setting fire on the second floor of the 1- and 2-story brick, wood-joisted building to cover evidence of burglary. Taking advantage of partial burglar protection that left certain openings to the cigarette storage area unprotected the burglar was able to make his way into and out of the building without detection. With no watchman or sprinkler protection, the fire burned undetected until noticed by a nearby tavern keeper at 12:10 A.M. It was coming through the roof of the 25,000 sq. ft. second story when apparatus arrived. The roof, second story and most of the 41,000 sq. ft. first story was destroyed or damaged. Three steel boxcars on a railroad siding between the building of origin and an adjacent 1-story warehouse shielded the latter structure and were of material assistance to fire fighters in confining fire to the building of origin.

Royce Craig

Aug. 25, Tulsa, Okla. This heavily loaded retail grocery warehouse had no automatic protection or watchman service. Fortunately the fire occurred while clerks were still on duty in the adjoining supermarket.

†Indicates business interruption loss.

Oct. 29, Evansville, Ind. This fire was set to conceal evidence of burglary. Because of incomplete burglary protection the burglar was able to get into and out of the building without being noticed. Absence of watchman and sprinkler protection permitted the fire to make great headway before discovery by an outsider.

Furniture

Mar. 12, San Francisco, Calif. Lachman Bros., Inc. $410,000.

Furniture store warehouse. The three upper stories of the unsprinklered 5-story masonry, wood-joisted building were badly damaged by a fast-spreading fire that originated in a furniture repair shop on the third floor. Fire broke out when an employee spilled an open gallon container of solvent on an electric heater for a finishing iron. Heat from the flash fire operated the central-station-supervised, rate-of-rise automatic detection system and also caused two sprinklers in the third story of an adjoining 5-story sprinklered building to operate before links on the fire doors in the doorway between the two buildings fused. Fire doors at all openings between the building of origin and the two adjoining buildings closed, confining fire to the building of origin. However, considerable water damage was suffered by one of the exposures due to a slight difference in floor levels.

Grain Elevators

Feb. 9, Gluek, Minn. Wesota Co. $396,000.†

150,000 bushels flaxseed, soybeans and oats in elevator and annex. Fire caused by heat generated by a slipping head pulley spread down through the 60-ft.-high elevator and into the communicating annex. Without water, employees could do nothing to check the fire and by the time fire departments from surrounding towns had arrived fire had developed to such magnitude that water in apparatus was of no value. Attempts to salvage soybeans were unsuccessful since the oil extracted from the beans by the heat of the fire burst into flame during overhaul.

Aug. 2, Lapwai, Idaho. Craigmont Grain Growers $300,000.

Elevator containing 75,000 bushels wheat, barley, rape, peas. Fire of unknown origin destroyed the unprotected 12,800 sq. ft. wood-frame, metalclad grain elevator. The blaze was discovered by a motorist at 3:00 A.M.

†Indicates business interruption loss.

San Francisco Call-Bulletin

March 12, San Francisco, Calif. Solvent spilled on an electric heater in the third story repair shop started a flash fire that involved the three upper floors of this furniture warehouse.

Aug. 20, Kalispell, Mont. General Mills, Inc. $300,000.

70,000 bushels of wheat, oats, barley, corn. Lack of an automatic alarm system or sprinkler protection allowed fire in the penthouse of the operating elevator to develop undetected until noticed by a passerby at 4:25 P.M. Fire burned down within the 100 ft. high wooden elevator until it could be reached with fire department hose streams. Efficient fire fighting kept the fire from seriously exposed wooden grain storage bins.

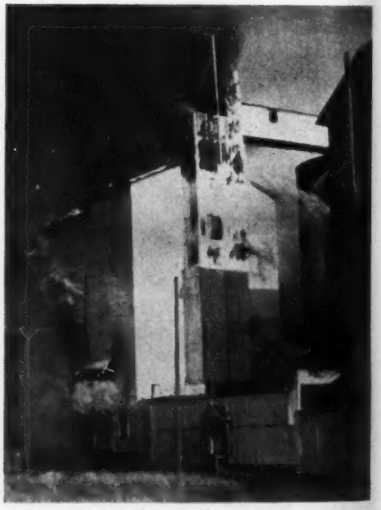
Sept. 14, nr. Tule Lake, Calif. Winema Farms Grain Elevator $469,000.

250,000 bushels malting barley in elevator. Fire originating in the head house of the 60-ft.-high metalclad elevator was not discovered until seen by a passerby at 10:45 P.M., 3½ hours after the last employee had left. The fire was well advanced when apparatus arrived, and since water had to be relayed by three pumpers from a drainage ditch ½ mile away, the fire could not be controlled until the elevator was destroyed. A recommendation by the fire chief that a sump for pumper suction be placed on the premises had been rejected by the operators of the elevator.

***Nov. 27, Marlin, Wash. Krupp Union Warehouse Co. $360,000.**

Two elevators, two 1-story bin buildings, 140,000 bushels grain. Lack of public and private fire protection was primarily responsible for extensive destruction caused by this fire. The fire occurred during a nonoperating period and had spread up a wooden leg in one of the 5-story-high wood-frame, metalclad elevators before discovery. The 800 gal. tank truck, maintained for protection of the town, was of little value at a fire of this magnitude. Since the nearest apparatus was more than 16 miles away considerable time elapsed before two 500 gpm pumpers were on the scene to relay water from a creek 1,500 ft. away. In the meantime fire had spread to a 1-story bin building adjoining one side of the elevator and had gone across a 27-ft.-wide space to another 1-story bin building and a 4-story elevator. Wooden grain bin doors stacked in the 27-ft. clear space were the means by which fire traversed the clear space.

*Fire spread to other buildings.



Aug. 20, Kalispell, Mont. Where automatic protection is lacking fires can reach serious proportions before discovery even when people are working in the building. That was the case in this grain elevator.

Hardware

April 30, Toronto, Ont. White Hardware Ltd. $500,000.

Paint, general hardware. Delayed fire department notification was an important factor in the destruction of the third story and roof of the unsprinklered 3-story brick, wood-joisted building. On discovering the fire in the third story paint spraying area, employees spent several minutes fighting the fire with fire extinguishers before notifying the fire department. By then fire was beyond ready control by hose streams.

Aug. 19, Toronto, Ont. White Hardware Ltd. $500,000.

Paint, general hardware. The second serious fire within four months to involve the 3-story brick, wood-joisted building destroyed the two upper stories of one wing. In both fires discovery was by an employee, but, whereas in the previous fire, delayed fire department notification (as employees tried unsuccessfully to extinguish the fire without professional help) was an important factor in the extent of damage, in this instance, fire department notification was prompt. However, the fire had made considerable headway before discovery so the end result was the same. The evidence from these two fires emphasizes the importance of providing sprinkler protection to assure both prompt detection and prompt extinguishment.

Nov. 7, Quebec, Que. Terreau and Racine $525,000.

Refrigerators and other retail hardware storage. Fire had reached such proportions in the large 1-story brick, wood-joisted warehouse when firemen arrived at 4:55 A.M. that all efforts were concentrated on saving a seriously exposed garage. The warehouse was unsprinklered and had no watchman protection.

Machinery

May 9, Vernon, Calif. Machinery Sales Corp. $400,000.

Machine tools, sheet metal storage and sales. The wood roof and two walls of the 20,000 sq. ft. masonry, wood-joisted building were destroyed and heavy stocks of machinery were damaged by fire that was coming through the roof when apparatus answered an outsider's alarm at 1:24 A.M. Origin was believed to have been in the vicinity of a small shop section. The fire emphasized the need for sprinklers in buildings of combustible construction even though the contents may be non-combustible.

May 15, Windsor, Ont. Ford Motor Co. of Canada Ltd. $500,000.

Obsolete machinery, wood paving blocks, etc. An old, 300-ft. by 100-ft. 1-story wood-frame, metalclad building crammed with obsolete machinery, past model parts and tar-soaked paving blocks was destroyed by fire discovered by an employee when he entered the building at 12:40 P.M. The plant fire department was summoned at once by means of a private fire alarm box, and when the driver of the plant fire truck arrived and realized the seriousness of the fire, the Windsor Fire Department was immediately notified. The combined efforts of these departments, however, could not prevent the fire from spreading throughout the undivided building as metal siding prevented fire fighters from getting water into the fire area. The fire is believed to have started in a pile of tar-soaked wood paving blocks.

May 15, Windsor, Ont. The combined efforts of the private and public fire departments could not save this 30,000 sq. ft. undivided and unsprinklered building crammed with obsolete machinery, parts of old model automobiles and tar-soaked wood paving blocks.

***Sept. 15, Saginaw, Mich. Baker Perkins, Inc. et al. $413,500.**

Bakery machinery; soft drink distribution. Two large 1-story combustible buildings were destroyed by fire that originated in the 30-inch space between the two structures. The fire is presumed to have been started by two boys, age 6 and 8, who were playing with matches between the buildings. No watchman was provided, and consequently children had free rein on the property and fire had ample opportunity to involve the wood-walled bakery machinery warehouse before detection by neighbors.

Mercantile Stocks

Sept. 28, New York, N.Y. Hecht Bros. $503,000.

Department store warehouse. The third through sixth stories of the unsprinklered 6-story warehouse were badly damaged by fire allegedly set in a box of straw on the fourth floor by a stock room clerk. His motive, as reported by newspapers, was to obtain the approbation of his neighborhood friends. Melting of fusible links on open fire doors between the warehouse and adjoining store allowed the doors to close and prevented fire from entering the latter building. The more than 500 customers left quietly when smoke filtered into the store.

Metal

May 15, Chicago, Ill. Borg-Warner Corp. $750,000.

Bath tubs, sinks, other plumbing supplies. Use of the new 50,000 sq. ft. noncombustible building (brick and unprotected steel) for storage before the sprinkler installation was completed resulted in almost total loss to the building and contents. The fire originated in crated stock while several employees were in the building. Despite prompt use of fire extinguishers, however, the fire spread rapidly through the crated contents and soon had control of most of the 500-ft.-long building.

***Dec. 23, Tampa, Fla. American Can Co., et al. $883,000.**

18,000,000 cans, fibre milk containers; dry ice mfg.; shrimp trawl storage. Fire of undetermined cause that broke out in the 54,750 sq. ft., 1-story wood-frame, metalclad can warehouse destroyed the warehouse and two small adjacent combustible buildings. When discovered by the watchman at 1:28 A.M., one hour after he had last passed the building, the fire was beyond control.

Lack of sprinklers and fire walls, a poor water supply and strong winds let the fire spread rapidly through the building of origin and into the two exposures. Fire fighters could possibly have halted the fire sooner had they drafted from a salt water supply at once instead of first trying to get an adequate water supply from the small sized yard mains (partly three-inch).

On the day following the fire, cans were to have been transferred from the warehouse to citrus processors under terms of a court injunction caused by a strike by employees.

Military

***June 17, Whittier, Alaska U. S. Gov't., Dept. of the Army $10,000,000.**

Pier, two pier warehouses, office building. A 2,323-ft.-long wooden pier, two sprin-

*Fire spread to other structures.

June 17, Whittier, Alaska. Incomplete sprinkler protection featured in this loss that destroyed two pier warehouses, an office building and 2,323-ft.-long pier. The fire started in the unsprinklered attic of an otherwise sprinklered pier warehouse.

klered wooden pier sheds 80,000 and 50,000 sq. ft. in area respectively, and a 3,600 sq. ft. sprinklered 2-story wooden office building on the pier were destroyed by fire that originated in the unsprinklered attic above the second story of the office building. On discovery at 5:15 P.M. the fire was attacked promptly by paid and volunteer fire fighters but due to dense smoke the attic could not be entered. Although sprinklers in the second story operated, the fire burned downward (probably over the exterior walls out of range of sprinklers) to the pier substructure and spread rapidly through its entire length. Heat broke the 8-inch salt water main beneath the pier supplying sprinklers and pier hydrants and overran sectional valves before they could be closed. Military supplies and equipment valued at more than $4,300,000 were in the destroyed warehouses.

Nov. 4, Madison, Wisc. U. S. Government, Department of the Air Force $423,000.

General military supplies. The unsprinklered and undivided 10,000 sq. ft. 1-story wooden building was destroyed by fire that originated when an overheated furnace ignited combustible fibreboard hot air ducts. Fire had made considerable headway before discovery, having spread to various parts of the building via the combustible hot air ducts.

Dec. 24, nr. Calgary, Alta. Royal Canadian Air Force $600,000.

Aircraft parts storage. A 244 ft. by 162 ft. wood hangar, used as a parts storage warehouse, was destroyed in a 4:20 A.M. fire, first discovered by security guards at the Air Force Base. High winds (reaching 45 miles-per-hour) handicapped Air Base fire fighters but through the combined efforts of the RCAF Fire Department, the nearby Currie Army Barracks Fire Department and apparatus dispatched from the City of Calgary, exposures threatened by flying embers and radiated heat were protected. A government investigation is in progress as to the cause.

Multiple Occupancy

***Feb. 1, Liberal, Kans. City of Liberal, et al. $525,000.**

Five buildings housing miscellaneous storage including floor covering, used cars, oil well equipment, musical instruments. Fire destroyed five 10,000 sq. ft. 1-story wood-frame, combustible fibreboard-walled buildings spaced between 50 ft. and 100 ft. of each other. The buildings were part of a large group at the Liberal Air Base that had been built and used during World War II by the U. S. Government. When discovered by a fireman-guard who was a mile away at the Base at the time, fire had control of half of the southernmost of the group of buildings. By the time the volunteer fire department from Liberal had hose lines in position, fire, driven by a light southwest wind, had involved four of the buildings. The fifth was soon involved. Others in imminent danger of ignition were saved by hose streams.

July 16, York, Pa. Home Insulation Co., et al. $250,000.

Builders supplies, furniture, oil burners. Lack of sprinkler and watchman protection allowed fire to spread beyond control in the 2-story brick, wood-joisted building before discovery by a passerby at 10:01 P.M.

Paper

***May 8, Los Angeles, Calif. Sterling Products, Inc., et al. $361,000.†**

Paper products. A delay in fire department notification of at least 20 minutes as employees tried to control fire in bales of scrap paper with portable extinguishers allowed the fire to spread beyond control before apparatus arrived. The unsprinklered and undivided 28,000 sq. ft. 1- and 2-story masonry, wood-joisted building was soon totally involved and but for outside and inside automatic sprinklers on the exposed side of a 1-story sprinklered furniture factory four feet away, fire would undoubtedly have destroyed this building also. Heat that penetrated through water curtains or entered through skylights caused 142 sprinklers to operate in the exposed building but a nearby dwelling was destroyed.

Rubber

***June 22, Philadelphia, Pa. U. S. Government, General Service Adm., et al. $1,715,000.**

950 tons baled crude rubber, tannin; bakery. An old 3,700 sq. ft. 4-story brick, wood-joisted building crammed with baled crude rubber and tannin collapsed due to overloading (estimated floor load 150 lbs. per sq. ft.; maximum floor load posted at 185 lbs. per sq. ft. in 1920). Debris fell into two exposures, one a sprinklered 2-story building loaded with rubber, and the other a 1-story bakery. Fire, probably caused by broken electric wiring, immediately broke

*Fire spread to other buildings.

†Includes business interruption loss.

June 16, Quebec, Que. A delayed discovery fire had involved most of the rolls of newsprint stored in this 57,120 sq. ft. building before discovery. Most of the loading doors were too hot to be opened when firemen arrived.

out and had involved the pile of debris and the two exposures when apparatus arrived. Due to the intense heat and dense smoke fire fighters experienced considerable difficulty in getting water on the fire and it was decided to use foam in an attempt to blanket part of the fire and thereby prevent spread to adjacent structures. Fire officials report that the partial foam blanket helped to save exposures and permitted them to concentrate on extinguishment. Two days later, however, the fire was still burning. It was decided to use wet water and the fire was out two hours later.

Terminal Warehouses

Oct. 11, Los Angeles, Calif. Marr Freight Transit, Inc., et al. $250,000.

Motor freight terminal containing miscellaneous combustible material, 28 trucks and 7 semi-trailers. Sixteen hours after the last employee left the 1-story steel-framed, metalclad building, an outsider noticed fire inside the undivided and unsprinklered 15,000 sq. ft. freight terminal. He attempted to telephone the alarm but could not because he did not have proper coins for a pay telephone. In the meantime someone else had noticed the fire and notified the fire department. When firemen arrived shortly thereafter the building was beyond saving. The fire was fed by large quantities of combustible stock and gasoline from exploding fuel tanks on trucks. Windows on exposures broke and efficient work was required to prevent spread to these buildings.

Associated Press Wirephoto

June 22, Philadelphia, Pa. Overloading of the 4-story warehouse with 1,900,000 lbs. of baled crude rubber caused this building to collapse. The ensuing intense fire required two days to extinguish.

***Oct. 16, Oakland, Calif. Robert J. Cooney, et al. $1,165,000.**

Two warehouses loaded with stock for overseas Army Post Exchanges; one empty warehouse. Three warehouses with total ground floor area of approximately 21,000 sq. ft. were destroyed by fire that was beyond control in a 2-story wooden building when discovered by a passing motorist at 8:38 P.M. Flames spread rapidly to the two exposed 1-story metalclad buildings, and would undoubtedly have involved other exposures but for successful efforts of fire fighters to surround and confine the fire to the three buildings. No sprinkler protection was provided and the substandard watchman service in this instance was worthless. The watchman was given sleeping quarters in one of the buildings in return for his services. Regular tours were not required. No information could be obtained as to the whereabouts of the watchman on the night of the fire.

*Fire spread to other buildings.

Wide World Photo

Oct. 16, Oakland, Calif. Substandard watchman protection often proves worthless in time of need. A watchman was given sleeping quarters in one of the three buildings destroyed in this fire in return for his services. Just where he was on the night of the fire could not be determined. The fire was discovered by a passing motorist.

June 16, Quebec, Que. Anglo Canadian Pulp and Paper Mills, et al. $756,500.

4,985 tons of newsprint. Lack of sprinklers and fire walls prevented control of fire, discovered by police at 2:00 P.M., until the 1-story metal building and its contents were destroyed. The 57,120 sq. ft. building was loaded with rolls of newsprint piled three tiers high, the bottom rolls on end and the rolls above on sides. Rolls were stored adjacent to loading doors that comprised two sides of the building. Most of the doors were too hot to be opened when firemen arrived. The seven hose streams were thereby unable to reach the fire and with no sprinkler protection, flames burned out of control until damage was practically total.

***Oct. 30, New York (Brooklyn), N. Y. Lion Trucking Co., et al. $351,000.**

Truck terminal. Fire of unknown cause that originated in a large pile of toilet tissue in cartons spread throughout the unsprinklered and undivided 1-story building of origin and to an adjacent 1-story wooden shed and two freight cars in the rear. Fourteen engine companies were required to prevent spread to additional combustible buildings in the congested district. Four firemen were injured fighting the blaze. Lumber yards in the area increased the spark exposure hazard.

*Fire spread to other structures.

Tobacco

Aug. 29, Lexington, Ky. Shelburne Loose Leaf Tobacco Warehouse, et al. $324,000.

Loose leaf tobacco sales house. The 85,800 sq. ft. 1- and 2-story brick, wood and steel-joisted warehouse, used during the off season for storage of 177 hogsheads of tobacco, 225 drums and 24 5-gal. cans of roofing paint, 400 rolls of roofing paper and 4 motor vehicles, was destroyed by fire discovered by a passing motorist at 5:47 A.M. The building was undivided and unsprinklered and had no watchman protection. The entire building was involved when apparatus arrived and a few moments later the walls fell. A good water supply, efficient fire fighting and favorable weather conditions, factors that are not always present, were the principal reasons that the fire did not destroy exposed warehouses and dwellings, several of which were scorched.

Wood and Wood Products

Feb. 27, Caruthersville, Mo. Cris-Craft Boat Building Co. $250,000.

Marine plywood, boat kits, mahogany lumber. A large amount of combustible contents, lack of fire divisions and automatic protection were responsible for destruction by fire of the 20,000 sq. ft. 1-story wood-frame, metalclad building. Following dis-

George Van

June 24, Jersey City, N. J. Thirty thousand cases of matches were the fuel for this fire. The photo shows how a parapeted fire wall and fire fighters confined the hot fire to the building of origin.

covery at 4:15 A.M. by the watchman, fire spread so rapidly through the combustible contents that fire fighting was mainly concerned with protecting exposures.

***Nov. 13, Baltimore, Md. Baltimore Plywood Co., et al. $500,000.**

Plywood storage; chemicals, electronics mfg. Lack of automatic and watchman protection for the 16,200 sq. ft. 1-story brick, wood-joisted building allowed fire to make considerable headway before discovery by an employee who entered the building at 12:47 P.M. to load a truck with plywood. Flames spread so rapidly through the undivided structure that there was no time to save company records in the adjoining and communicating office building.

Miscellaneous

June 24, Jersey City, N. J. Ohio Match Co. $300,000.

Matches. The unsprinklered and undivided 1-story brick, wood-joisted warehouse in which 30,000 cases of matches were stored was quickly destroyed by fire discovered at 5:15 P.M. by the only employee in the building. Fire fighters with the valuable assistance of a parapeted fire wall were able to save an adjoining 1-story plastics fabricating plant. (Note fire fighter use of fire wall in photograph on this page.)

July 8, Brooklyn, N. Y. New York City Dept. of Purchase $250,000.

Lubricating oil, paint, turpentine, etc. Fire originating in a pile of rubbish entered the building grounds through a hole in a fence and spread to the interior of the 1-story, wood-frame, metalclad building. Discovery was by a policeman on traffic duty outside the building. Before apparatus arrived flames had spread to bagged sawdust piled on the wooden floor of the 40,000 sq. ft. building. Fire spread to all parts of the building via the roof, involved lumber piled against the building and damaged 70 vehicles.

*Fire spread to other buildings.

$12,000,000 in 29 Store Fires, 1953

Twenty-two of the 29 large loss fires in mercantile properties originated during non-operating periods. To protect against this threat of fire in the night, a threat which the NFPA has reported consistently*, only one of these stores had provided even a measure of automatic protection and this was a partially sprinklered dry goods store with sprinklers in all but the fourth floor of the 4-story building. As so often happens, the fire originated in the unprotected area. The loss amounted to over $1,000,000. Furthermore, in no case was even watchman service provided in these closed stores to guard values which these 22 fires proved to have amounted to about $12,000,000. This is an average per fire of over $400,000! Is this risk worth while?

Twenty-two of these serious fires broke out during non-operating periods, two on Sunday. Attention was first directed to four by explosions; 19 were detected by outsiders, passersby or police. Twenty-seven of the 29 involved delayed detection for one reason or another.

Twenty-five of the 29 large loss store fires of 1953 occurred in ordinary, brick, wood-joisted buildings. The other four were in wood structures. Other structural features contributing to the spread of fire were insufficient fire divisions (10 cases), open stairwells (9 cases), open elevator shafts (4 cases), large undivided attics (3 cases) and non-firestopped horizontal concealed spaces and walls (2 cases each). Combustible fibreboard was cited as being a measurable influence in rate of flame spread in two cases.

The NFPA pamphlet "Must Stores Burn?" reported that 42.7 per cent of 5,203 fires started in basements. The large loss fire record of 1953 shows that this trend is consistent because in 41 per cent of the stores having below grade floors, the origin of the fire was traced definitely to basements.

One of the principal characteristics of store fires is that about 50% of them spread from the structure of fire origin to other exposed buildings. Most of these stores are, naturally, in built-up areas and once a fire gets a good start in store properties, exposures are seriously threatened. In the record this year, there were 13 fires that communicated to adjoining properties. The principal reasons for this were inferior combustible construction, poorly constructed party walls and ordinary glass windows. Property owners are, therefore, particularly subject to the protection short-comings of their neighbors and many cities have attacked this problem by legislation requiring the installation of automatic protection in, at least, all store basements.

The most tragic of the store fires of 1953 occurred at Aiken, S. C. on January 27. In this instance, a gas explosion, followed by fire, killed 10 people in the buildings involved. The explosion could probably have been prevented if a serious investigation had begun when the presence of gas was first detected some 16 hours before the blast occurred.

Twenty of the 29 fires occurred in towns having over 10,000 population where it could be expected that trained fire department personnel were available for fire fighting. Yet in 10 cases, it was noted by the NFPA staff study that the extent of fire on arrival of fire departments forced fire fighters to concentrate on protecting exposures. This is another indication of the importance of prompt detection and should serve to emphasize the need for private automatic fire protection equipment in these high value properties. In several of the stories and pictures included herein, the problems presented to fire fighters by windowless walls may be noted.

*See, for instance, NFPA Pamphlet "Must Stores Burn?" which reports that 75.8% of 2,010 store fires analyzed therein, started during non-operating periods.

United Press Photo

Jan. 5, Kansas City, Mo. An explosion in a 3,750 sq. ft. restaurant building created this havoc at 3:01 A.M. Experts investigating the accident disagree as to whether gas was responsible.

Jan. 7, Paducah, Ky. This tire originated on the only floor (4th) not sprinklered and overtaxed sprinklers on the other three floors.

***Jan. 5, Kansas City, Mo. Chili Bowl, et al. $341,500.**

Restaurant, store, offices, tavern. At 3:01 A.M., two hours after the last person had left the building, a violent explosion leveled a 3,750 sq. ft. 1-story brick, wood-joisted building and blew down a fire wall separating the building of origin from an adjoining 4,500 sq. ft. brick, wood-joisted building. Fire spread throughout the two adjoining buildings. Fifteen additional buildings suffered broken windows or other explosion damage. The explosion presumably involved gas although there is disagreement among experts on this point.

Jan. 7, Paducah, Ky. This aluminum 95-ft. aerial ladder was ruined by heat during store fire.

***Jan. 7, Paducah, Ky. Paducah Dry Goods Co. et al. $1,058,000.†**

Department store, dress shop. A partially sprinklered 4-story brick, wood-joisted building and an adjoining unsprinklered 3-story building were destroyed by fire that originated in the unsprinklered top story of the otherwise sprinklered 4-story structure. Sprinkler protection was removed from the fourth story in 1946 when a ceiling was suspended beneath sprinklers. Fire was discovered at 12:40 A.M. when sprinklers in the third story opened and transmitted the alarm through a direct connection to the fire department. Flames, by then, had involved most of the two upper stories. Lack of automatic dampers in a 2 ft. by 3 ft. air conditioning duct that pierced a fire wall to serve an adjoining unsprinklered 3-story building permitted fire to spread to the exposure. Less than 30 minutes after the alarm, both buildings were involved and walls were falling in.

Jan. 15, Pueblo, Colo. Colorado Supply Store $294,000.

Department store. The unsprinklered 15,000 sq. ft. 1-story masonry wood- and steel-joisted building and its huge stock of merchandise were destroyed by fire that was discovered by the owners as they left by the back door after closing up for the night. When attempts to control the fire with a soda-acid extinguisher failed, it was found impossible to reach a telephone on the mezzanine, because of heat and smoke. The alarm was finally telephoned from a cafe across the street. Despite the delayed notification, firemen are at a loss to explain the extent of fire on their arrival. Dense black smoke coming from all windows hampered fire fighting and when fire got above the suspended metal ceiling and into the attic, there was no hope of saving the building.

***Jan. 16, Cheboygan, Mich. Masonic Temple Building, et al. $300,000.**

Lodge hall, poolroom, offices, stores. Fire burned undetected in the unsprinklered 3-story brick, wood-joisted lodge building until a smoke explosion blew out windows and gave the alarm at 4:45 A.M. With 2-story wooden buildings on either side in imminent danger of catching fire, mutual aid was summoned at once. This prompt action paid off since fire was confined to the three buildings although other combustible exposures were nearby, including one 4 ft. from the fire.

***Jan. 27, Aiken, S. C. Jones Electric Co., et al. $500,000; 10 killed.**

Mercantile stores including an electrical appliance store, two drug stores, a department store and a ladies'-ready-to-wear store. A gas explosion severely damaged a group of mercantile stores on Laurens Street and Richland Ave. killing 10 persons, injuring 5 and starting a raging fire which required help from two outside fire departments to extinguish. Escaping gas was first detected about 4 P.M. on January 26. Shortly after 6 P.M., the owner instructed one of his employees to close the gas supply valve at the meter in the basement. When the store reopened at 8:00 A.M., January 27 a strong odor of gas was noticed. One of the employees opened all doors, started two pedestal type electric fans on the first floor and then joined other employees who were trying to locate the gas leak.

*Fire spread to other structures.
†Includes business interruption loss.

Jan. 16, Cheboygan, Mich. Discovery was so long delayed that a smoke explosion which blew out windows attracted the necessary attention at 4:45 A.M. Mutual aid fire fighters helped measurably to protect exposures.

The gas company was notified at 8:30 A.M. At 8:31, the explosion occurred.

When the fire department arrived after a telephone alarm, the walls of the electrical appliance store were found blown down by the blast and this store, the adjoining Platt's Drug Store and McCreary's Department Store were enveloped in flames, making any rescue attempts in this area impossible. Help was requested from Augusta and the Atomic Energy Commission Savannah River Project. Flames spread through the damaged brick walls and unprotected window openings to involve two other stores. Leaking gas from two one-inch gas service lines in the electrical appliance store and from one line in McCreary's fed the flames.

The gas responsible for this explosion was supplied by the utility company serving the community from its local plant. It consisted of butane diluted about 50 per cent with air before distribution to street mains at about 4 pounds per square inch pressure. The exact origin of the gas leak has not been reported

Wide World Photos

Jan. 27, Aiken, S. C. A gas explosion in an electrical appliance store was so severe that a whole group of neighboring stores were immediately involved. Ten persons were killed and damage is estimated at $500,000.

but some suspicion has been directed to the underground piping in an adjacent alley which is used by small trucks. The surface of the alley consists principally of soft, sandy type soil. The gas control valve in the electrical appliance store was found in a closed position after the debris was removed.

Jan. 27, Roseville, Mich. World Furniture Co. $500,000.

Furniture store. Rubbish piled against the oil-fueled furnace in the combination packing and furnace room was the probable point of origin of fire that destroyed the unsprinklered and undivided 1- and 2-story 40,000 sq. ft. masonry, wood-joisted building. The fire was confined to the furnace room when discovered by police at 1:09 A.M. but soon burned through the ceiling and spread laterally within the unsprinklered concealed space formed by the roof and ceiling. Explosion of fire gases that rapidly filled the sales area blew out windows a few minutes after apparatus arrived. On the last inspection of the building by the fire department, March 13, 1952, the owners were ordered to remove rubbish from the vicinity of the furnace.

***Feb. 1, Geneva, Ill. Ace Hardware Co., et al. $250,000.**

Five 2-story buildings housing hardware store, offices, barber shop, apartments. Originating in the basement of a 2-story building occupied by a hardware store and apartments, fire spread rapidly to combustible buildings on either side. The stone, wood-joisted bank building, two buildings from the building of origin, was ignited when heat ignited the eaves. Currency and records were removed under heavy guard to a bank in Elgin before fire destroyed the bank building.

***Feb. 1, Collingwood, Ont. Foley Furniture and Appliance Store, et al. $500,000.**

Four stores, two apartments. Two 3-story brick, wood-joisted buildings were destroyed by fire that originated in the storage section in the rear of a first story furniture store. Smoke awakened a second story apartment occupant in time to give the alarm and arouse other tenants. A frozen hydrant in front of the building delayed fire fighting slightly but was not considered to have had much bearing on the outcome since fire had already made considerable headway in the storage section, and soon spread vertically through open stair and elevator shafts. Fire spread to the adjoining 3-story building through joist sockets that extended through the fire wall.

***Mar. 9, Cadillac, Mich. Freedman Building, et al. $300,000.**

Offices, restaurant, stores, apartments. Two buildings were destroyed and a third damaged by fire that originated in a doctor's office in the basement of the 2-story brick, wood-joisted building. The alarm was given by second-story tenants at 7:15 P.M. although smoke had been noted for some time previously. Believing the furnace was smoking (as it had done in the past) they hesitated to call the fire department. Fire had entered partitions before apparatus arrived and spread rapidly through two adjoining buildings after burning through into a stairway common to both buildings. The second story of a 2-story building in the rear was damaged when fire burned through a boarded window.

Mar. 10, Springfield, Ohio C. B. and J. S. Zimmerman, et al. $353,000.†

Offices, drug store, restaurant. Fire originating in an accumulation of paint cans, brushes and rags in a basement work bench spread throughout the basement. An explosion that blew out basement windows at 2:34 A.M. gave the alarm. Fire fighters attacked the basement fire with hose streams but flames entered a pipe shaft and spread vertically to all stories and the roof of the unsprinklered 4-story brick, wood-joisted building.

***Mar. 13, Deming, N. M. Tidmore's, et al. $580,000.**

Three dry goods stores, drug store, theatre, pool hall, saloon. An explosion (probably fire gases) at 5:40 A.M. blew out windows and a wall of a 9,100 sq. ft. 1-story brick, wood-joisted dry goods store and broke windows in 1-story buildings at the rear. The building of origin was enveloped in flames when firemen arrived, and fire spread into adjacent exposures through windows broken by the explosion. Fire entered a drug store adjoining the building of origin by way of the roof since the masonry wall between the two buildings had a parapet of about 6 inches. Two other walls, properly constructed and parapeted, were valuable aids to fire fighters in their efforts to check the fire.

***Mar. 22, Danville, Ill. S. S. Kresge Co., et al. $565,000.**

Department store, dress shop, offices, hotel. Absence of sprinklers in the basement of the 2-story brick, wood-joisted building permitted

*Fire spread to other structures.
†Includes business interruption loss.

Bill McCuddy

March 10, Springfield, Ohio. This fire, as in most mercantiles, originated in the basement. Flames spread vertically to all stories through a pipe shaft. No one knew of the fire until an explosion blew out basement windows at 2:34 A.M.

Commercial-News Photo

March 22, Danville, Ill. Another smoky basement fire could not be controlled by fire fighters and flames spread vertically and horizontally through unprotected openings. An adjoining 12-story fire-resistive building (from which this photo was made) was saved by fire department hose streams and wired glass windows.

fire to spread beyond control and destroy two buildings and damage a third. Firemen summoned by an outsider's alarm at 3:45 P.M. (Sunday) found a comparatively small fire in the basement but because of heat and dense smoke men protected by masks and life lines were not able to stay inside long enough to bring the blaze under control. Fire spread to the rest of the building through unprotected vertical and horizontal openings and into the rear of an adjoining 4-story building at the first story level through a hole made in the intervening fire wall when an I-beam was installed. Fire spread up an open elevator shaft to the fourth story and roof of the 4-story building. Hose streams and wired glass windows prevented fire from entering an adjoining 12-story fire-resistive building.

April 5, Marquette, Mich. Nester Block $315,500.

Stores, offices, dental laboratory. A second story dental laboratory was the point of origin of fire that heavily damaged part of the unsprinklered 4-story brick, wood-joisted building. Responding to a pedestrian's alarm at 3:39 A.M., firemen found flames issuing from rear second story windows and extending through a light well to the roof. A masonry division wall was an aid to firemen trying to save part of the building but substandard features of the wall threatened to defeat their effort. Fire spread over the substandard 8-inch parapet and ignited the roof of the exposed section. Fire also would have entered through doorways provided with substandard metalclad doors (which were always kept open) had not firemen been posted at these doorways with hose streams.

***May 4, Baltimore, Md. Lafayette Market, et al. $1,000,000.**

Food market with individual stalls; 39 store and dwelling exposures. The threat of unsprinklered large wooden buildings to exposures was shown by fire that originated in the 34,500 sq. ft. 1-story wooden market building and spread across four bounding streets to 39 store and dwelling buildings before being brought under control. The fire had burned for a considerable time before discovery by an outsider at 3:30 A.M. and had reached such proportions that additional alarms were immediately sounded.

May 18, Albuquerque, N. M. Sears, Roebuck Co. $900,000.

Department store. The owners of this store can place the blame for its destruction on their own shoulders since they had not provided a watchman or automatic protection to assure prompt detection and control of fire during nonoperating periods. Had a watchman been present he undoubtedly would have apprehended the small girl that broke into the store after hours, outfitted herself in western togs and then built a fire in a waste container in the shoe department. Had automatic protection been provided, the fire undoubtedly would have been controlled promptly.

May 27, Baltimore, Md. Shofer's Furniture Co., Inc. $250,000.

Furniture store. Another example of what can happen when stores are left during the night without automatic protection or a watchman was the fire that destroyed a large part of the 15,000 sq. ft. 1 to 4-story brick building. The fire originated in the basement and must have been burning several hours before discovery by an outsider at 2:20 A.M. By that time the entire first story was involved and fire soon spread through an elevator shaft to the fourth story and through the roof. The fire spread up through the shaft because trap doors at each floor level failed. Heavy timber floor supports in the basement withstood the fire although much of the flooring was consumed.

May 28, Alva, Okla. Montfort Drug Store, et al. $283,000.

Drug store, restaurant, offices. The need for automatic sprinkler protection for basements of stores was again emphasized when fire destroyed the unsprinklered 2-story brick, wood-joisted building. Originating in the basement of the drug store after the store had closed, the fire was not discovered until seen by police in a cruiser at 1:30 A.M. Fire spread to the first story through open stairways and to the second through open stairways and by means of second story windows.

June 2, Yuma, Ariz. J. C. Penney Co. $365,000.†

Department store. Two hours and 45 minutes after smoke was first observed coming from a ventilator, an outsider notified the fire department of fire in the unsprinklered 12,000 sq. ft. 1-story masonry building. In the interim customers had advised store employees of smoke but this was attributed to locomotives in a nearby freight yard. Fire was confined to the concealed space between the wood roof and combustible ceiling above the mezzanine when fire

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*Fire spread to other structures.
†Includes business interruption loss.

R. F. Kniesche

May 27, Baltimore, Md. A total loss to stock resulted from this furniture store fire which was discovered by an outsider at 2:20 A.M. There was no automatic protection, no watchman, and, as usual, the origin was the basement.

men arrived but it could not be easily reached from the roof or from the mezzanine. When the ceiling collapsed 15 minutes later the building had to be evacuated.

Spain Flying Service

June 2, Yuma, Ariz. Smoke bothered occupants for over 2 hours before an alarm was sounded. The entire 12,000 sq. ft. unsprinklered store was gutted after flames burst from the concealed space between the roof and combustible ceiling.

June 8, Scranton, Pa. Betty Lou Juniors, Inc., et al. $259,000.

Wholesale dress distributor. The first story and roof of the 1-story and basement brick, wood-joisted building were destroyed by fire that originated in stocks of cotton summer dresses stored on double-tiered racks. Although five employees were in the area when the fire was discovered simultaneously by an outsider and firemen at a nearby station, none of the employees apparently noticed it. A 6-inch reinforced concrete first floor kept fire from the basement.

***June 24, New Brunswick. N. J.; S. Neiderman, et al. $374,500.**

Six buildings housing stores, apartments and offices. Non-firestopped walls and ceiling spaces, lack of sprinklers, undivided attics and lack of fire walls between old 2- and 3-story wooden buildings (with deceptive modern fronts) were factors responsible for destruction of the six buildings. At 9:54 P.M. firemen were summoned by a tenant to extinguish a fire in the basement of a dress shop in one of the buildings, believed caused by a defective oil burner. The visible fire was quickly extinguished and fire fighters went home, but apparently fire had entered the concealed ceiling space where it burned undetected until occupants were awakened by smoke at 1:26 A.M. Fire by this time was spreading within nonfirestopped walls and ceilings. An unpierced fire wall prevented spread into an adjoining 3-story building.

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*Fire spread to other structures.

June 24, New Brunswick, N. J. A basement fire was believed extinguished about 10 P.M. At 1:26 A.M. firemen were called back to handle this fire which raked six buildings.

June 29, nr. Hanford, Calif. State Market $292,500.

Supermarket with toys and variety departments. Due to the extent of fire on discovery and the apparently long period of undetected burning, cause and point of origin of fire could not be determined. The alarm was transmitted by a passerby at 3:23 A.M., 20 minutes after telephones in the building had gone out of order. Three minutes after apparatus arrived the roof of the center section of the 19,800 sq. ft. building collapsed and soon thereafter the adjoining sections were in flames. Hollow concrete block walls divided the masonry, wood-trussed building into three sections but the walls were not parapeted and openings were unprotected. Needless to say, the building was unsprinklered and without watchman protection.

July 7, Tacoma, Wash. Safeway Stores, Inc. $260,000.

Supermarket. Lack of automatic protection or watchman service delayed detection of fire that originated in the concealed attic until seen by a passerby at 4:25 A.M. Fire had spread throughout the blind attic before apparatus arrived and later spread over combustible fibreboard finish in the sales area. Windowless walls and imminent danger of roof collapse prevented firemen from ventilating the smoke-filled building or making effective use of hose streams until flames broke through the combustible roof of the undivided 12,700 sq. ft. 1-story masonry-walled building. The fire was caused by friction of a belt against the frozen drive shaft on a fan of an air conditioning system. The shaft froze when the fan came loose and jammed in the housing.

July 11, Cleveland, Ohio Butler Bros. $375,000.

Furniture and appliances. A street alarm box pulled by a passerby at 1:15 A.M. brought firemen to fire that had made considerable headway in the basement of the 1-story masonry, wood-joisted building. Despite absence of sprinklers and the presence of dense smoke that required use of self-contained breathing equipment, firemen were able to confine actual fire damage to the basement. Part of the 4-inch poured concrete first floor sagged when wooden joists were destroyed.

***Aug. 11, York, Pa. York Furniture Center, et al. $250,000.**

Two furniture stores, 12 apartments. Originating in an elevator shaft, fire spread up through the shaft to all floors of the unsprinklered 4-story brick, wood-joisted building as firemen rescued several occupants of upper floor apartments over ladders. An adjoining 4-story building was also severely damaged when fire jumped a parapeted fire wall and ignited the roof. Fire fighting was handicapped by bursting hoses and a defective hydrant.

Sept. 30, Monticello, Ind. Sixbey's, Inc. $340,000.

Supermarket. Awakened at 4:00 A.M., a neighbor across the street discovered fire that was by then beyond control in the 12,000 sq. ft. 1-story masonry, wood-joisted building. The fire originated in the not-cut-off restaurant and because of the presence of a combustible fibreboard ceiling and absence of fire walls spread through the undivided and unsprinklered building. Since no safe was provided, all records and $6,000 in cash in the store were destroyed. Insurance loss was $15,000 on building and $80,000 on stock.

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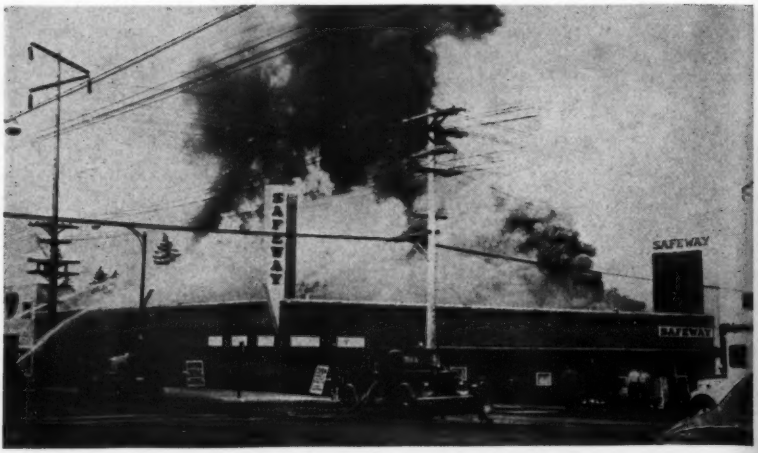
*Fire spread to other structures.



July 7, Tacoma, Wash. Windowless walls and danger of roof collapse handicapped firemen in handling this "Safeway" supermarket fire. Origin: air conditioning unit in concealed attic space. Factors: no sprinklers, no detection equipment, delayed discovery, and combustible fibreboard interior finish.

Oct. 9, Terre Haute, Ind. Terre Haute Heavy Hardware Co. $403,000.

Iron, steel and structural material, mill supplies, heating equipment, etc. Fire that originated in the boiler room and destroyed the unsprinklered 1-story wood-frame, metal-clad building was an ironic climax to Terre Haute's observation of Fire Prevention Week. Fire spread from the not-cut-off boiler room to the rest of the undivided and unsprinklered 1-story wood-frame, metal-clad building and was beyond control when reported by an outsider at 10:56 P.M.

***Nov. 2, Celina, Ohio Celina Auto Co., et al. $279,000.**

Auto sales, service; furniture; rugs; candy; cafe. Five 1- and 2-story buildings were destroyed by fire that originated in the 2-story brick, wood-joisted auto sales and service building and was beyond control when discovered by a passerby at 6:05 A.M. Lack of fire walls between some buildings and unprotected window openings in walls between others allowed fire to spread from one to another of five adjoining buildings. No automatic protection or watchman service was provided for any of the buildings.

Dec. 7, Union City, Pa. Wagman's 5c to $1.00 Store, et al. $250,000.

Department store, clothing store, beauty shop, four apartments. Originating in the not-cut-off boiler room, fire spread throughout the basement and eventually burned up through the unsprinklered 2-story wood-frame, brick-veneered building. Bricked up windows and smoke from plastic toys stored in the basement were severe handicaps to firemen and prevented confinement of fire to the basement.

Dec. 28, West Allis, Wisc. Federated Department Stores, Inc. $260,000.†

General merchandise, except furniture. The second story and roof of the 2-story brick, wood-joisted building were destroyed by fire believed caused by an overheated refrigerator motor in the employees' lounge on the second floor. The building had no automatic or watchman protection and consequently the fire had made considerable headway before chance discovery by a passerby at 5:50 A.M. On receiving an incomplete telephone report of the fire, the police department investigated to verify before passing the alarm to the fire department.

*Fire spread to other structures.

†Includes business interruption loss.

Thirteen School Fires — $4,985,500 Loss

Hamilton Spectator

Jan. 2, Hamilton, Ont. This fire, believed set on the first floor, was through the roof of building when discovered by police at 4:39 A. M. An 80,000 volume library on the first floor of the college classroom building was badly damaged.

The thirteen largest school fires of 1953 caused $4,985,500 loss or more than 20 per cent of the total 1953 school fire loss. There was wide diversity in the types of buildings involved in these school property fires ranging from classroom buildings to research laboratories. There was, however, very little variation in the factors responsible for these losses and we can therefore conclude that school fire safety depends primarily on control of hazardous conditions common to school buildings as a whole.

Delayed discovery, for example, can be disastrous in any fire. Twelve of the thirteen school fires occurred when the schools were unoccupied, and had spread beyond control before discovery. None of the school buildings was protected by sprinklers, automatic detection equipment or standard watchman service. Any one of these probably would have detected these fires when small.

Glaring structural weaknesses played prominent parts in most of the thirteen large loss school fires. Lack of fire walls where they could and should have been installed to subdivide excessive areas resulted in total destruction in five instances. Fire spread through large undivided attics in four cases, up open stairways in five of the eleven fires in multi-storied buildings, and spread through a combustible exhaust duct in one instance.

With delayed discovery so prevalent in school fires, public fire fighting was usually concerned primarily with protecting exposures. That none of the fires involved more than one building speaks well for the abilities of the fire department involved. However, it is important to note that in three cases fire fighting was handicapped by inadequate water supplies which resulted in heavier losses than would otherwise have been necessary.

Jan. 1, Franklinville, N. C. Franklinville High School $340,000.

Classrooms, auditorium. During the night fire broke out in the supply and equipment room on the first floor of the 2-story brick, wood-joisted school. When the building was entered by the janitor at 6:00 A.M. it was heavily charged with heat and smoke although the fire was confined to the room of origin. As soon as firefighters ventilated the building, however, fire spread rapidly, and since water in booster tanks was the only supply for fire fighting, there was no chance of saving the structure.

Jan. 2, Hamilton, Ont. Province of Ontario $350,000.

Teachers college classroom building. Fire discovered by police at 4:39 A.M. was through the roof of the unsprinklered 3-story brick, wood-joisted building and had involved all stories when apparatus arrived. The fire may have been set on the first floor. Recently installed stairwell enclosures kept fire from spreading vertically through stairwells but fire spread upward within non-firestopped partitions. An 80,000 volume library on the first floor was damaged.

Jan. 8, Belleville, Mich. Van Buren Twp. Consolidated Schools $325,000.

High school. The basement, second story and attic of one wing of the 2-story brick wood-joisted building were badly damaged by fire that originated in the athletic equipment storerooms in the basement. After tracing the odor of smoke to its source, the janitor delayed fire department notification until after unsuccessfully trying to extinguish the blaze with two carbon dioxide extinguishers. The fire burned through a 4 ft. by 4 ft. wood panel door to the pipe shaft and spread through the shaft to the attic.

Jan. 8, Belleville, Michigan. This fire might have been confined to the basement of the high school building had the fire department been called promptly. On discovering the fire in a basement storeroom, the janitor tried unsuccessfully to put it out with carbon dioxide extinguishers before giving the alarm. The fire spread through a pipe shaft to the attic before apparatus was at the scene.

Minneapolis Star

Feb. 9, Minneapolis, Minn. Fire departments are provided for fire fighting, not for detection, as is emphasized by the university laboratory fire in the picture. Fire was beyond control in the unsprinklered laboratory building at right when discovered by a newsboy at 5:00 A. M. although the laboratory was next door to a fire station. This fire also illustrates the fact that substandard watchman protection cannot be relied upon to detect fires promptly. A motorized patrol checked the building at irregular intervals and a foot patrol went inside twice a night.

Jan. 16, Elkhart, Ind. Elkhart University, et al. $331,000.†

Business college, clothing and jewelry stores. The top story and roof of the unsprinklered 3-story brick, wood-joisted building were destroyed by fire that originated at a defective electric wall panel in the X-ray developing laboratory in the third story. The fire burned within third story partitions and above the ceiling and could not be reached with hose streams effectively until it broke through the roof.

Feb. 5, Lockhart, S. C. Lockhart High School $275,000.

High and elementary school. Originating in the basement storeroom, fire had involved most of the basement of the unsprinklered 2-story brick, wood-joisted building before discovery by a passerby at 9:30 P.M. By then, the fire was too large to be controlled by hose streams from two 500 gpm pumpers, one of which was owned and operated by a mill in the town and the other by a town 11 miles away. Fire burned up through the wooden first floor and then spread through open stairways to the second story.

Feb. 9, Minneapolis, Minn. University of Minnesota $991,000.

Aeronautical research laboratory. The 41,000 sq. ft. 2-story brick, wood-joisted building was destroyed by fire that was beyond control when discovered by a newsboy on his way to deliver a paper to the adjacent fire station at 5:00 A.M. Fire was through the roof by the time hose streams were in operation and soon had complete control of the experimental laboratory. A parapeted fire wall with protected openings prevented spread to an adjoining building of about the same size. The fire apparently originated in the basement in the vicinity of, but not in, a transformer vault. Flames enveloped a large wind tunnel in the basement constructed of plywood, and fed on other combustible construction and contents, including several drums of flammable liquids, as it spread through the undivided building. Absence of sprinkler protection was the outstanding fire protection weakness but substandard watchman protection was also an important factor in the degree of damage. A motorized patrol checked the campus at irregular intervals and a foot patrol entered the laboratory twice a night. Nothing unusual was detected by the foot patrol at 2:15 A.M. or the motorized patrol at 4:30 A.M.

Mar. 9, Spring Valley, Ill. St. Bede College $505,000.

Gymnasium. The 2-story brick, unprotected steel-frame and wood-joisted building was destroyed by fire that originated in the concealed space between the 1-story ceiling and the floor of the second story gymnasium.

†Includes business interruption loss.

Firemen, summoned at 12:30 A.M. by a janitor who slept in the gymnasium, entered the building with small stream equipment but were driven out by dense smoke. By the time pumpers could be located at private hydrants and hose laid, fire had broken through into the gymnasium floor, ignited stage curtains and props and spread to the wood roof deck. Shortly thereafter steel beams gave way and the roof collapsed. Water supplied by a 100,000 gal. elevated tank on the college grounds was used to confine fire to the building of origin.

May 8, Fayetteville, Tenn. Lincoln County High School $451,000.

High school. An unsprinklered, 3-story, brick, wood-joisted school building was totally destroyed by fire discovered by a passerby at 11:45 P.M. Earlier in the evening a play had been presented by the Senior Class and investigation by Chief W. C. Foster of the Fayetteville Fire Department indicates the fire cause to be faulty wiring on the stage. The entire auditorium was involved upon arrival of fire fighters and lack of fire division partitions or stairwell enclosures permitted the entire 180 feet by 210 feet structure to be quickly involved. Insurance coverage amounted to $145,000, only about 32% of the sound value of the building and its contents. The **Lincoln County News** reports that all of the school's records (dating back to 1929 when the building was erected), as well as diplomas for the June graduating class, were lost.

June 21, Haney, B. C. Maple Ridge High School $292,500.

High school. Originating in the janitor's closet in the basement, fire had charged the 16,000 sq. ft. 2-story brick, wood-joisted building with smoke before discovery by police at 5:30 A.M. When the basement was opened by firemen, flames quickly involved the entire building, spreading over combustible fibreboard partitions and up open stairways. A maximum water supply of 250 gpm from each of two hydrants nearest the fire hampered fire fighting.

Sept. 15, S. Amboy, N. J. St. Mary's High School $250,000.

Parochial school. At 3:30 P.M., after classes had been dismissed but while still a few pupils and teachers were present, fire was discovered by a passerby who saw flames issuing from the building. All occupants left safely before flames spread up through the old 3-story brick, wood-joisted building damaging the upper floors and roof. No information is available as to the cause or point of origin of the fire.

Press—Citizen

Oct. 7, Iowa City, Iowa. A temporary wooden roof placed on this otherwise fire-resistive building 30 years ago is being destroyed by fire that started in a laboratory hood in the top story.

Press—Citizen

Oct. 7, Iowa City, Iowa. A wooden exhaust duct was the means by which fire originating at this laboratory hood in the top story spread to the attic.

Sept. 24, Stone Mountain, Ga. Stone Mountain Elementary School $250,000.

Classrooms, cafeteria, auditorium. Defective wiring above the cafeteria ceiling was the reported cause of fire that destroyed the 1-story brick, wood-joisted building. The fire was discovered by a passerby at 9:00 P.M. at which time heat and smoke prevented entry with hose streams. Delay in calling for mutual aid and poor water supplies prevented control.

Oct. 7, Iowa City, Iowa University of Iowa $375,000.

Chemistry and botany laboratories, classrooms. The wooden roof of an otherwise fire-resistive 5-story wing of the building was destroyed and the fifth story was badly damaged by fire that originated when a student dropped a 5-lb. bottle of ether in a hood in a laboratory on the fifth floor. Vapors were ignited immediately, either by an electric oven under the hood or the non-explosion-proof hood motor, and fire flashed through the wooden exhaust duct that extended horizontally through the concealed space beneath the roof. Flames soon burned through the duct and spread within the undivided roof space to all rooms on the top floor. As a temporary expedient thirty years ago the wood roof had been placed on the otherwise fire-resistive wing.

Dec. 12, Beloit, Wisc. Beloit College $250,000.

College chapel. Concealed spaces played a vital part in the extent of fire damage to the unsprinklered 1-story masonry, wood-joisted building. Originating in a janitor's supply closet in the basement, the fire spread through false columns enclosing 12-inch by 12-inch roof supports and entered the undivided concealed space between the auditorium ceiling and roof before discovery by a student at 6:10 P.M. The fire in the basement was extinguished and the flooring and seats of the auditorium were unburned, but the roof and ceiling were destroyed. An arsonist has confessed setting the fire.

Three Large Electric Generating Plant Fires

Steam, water and diesel powered electric generating plants were each represented among the large loss fires occurring in 1953. Although there were certain differences in the design and operation of these plants, the experience from these three fires illustrated certain hazards and fire protection weaknesses that may be found in any electric generating plant, irrespective of power source. Each of the fires, for example, started with accidental release of a flammable liquid and in each instance the flammable liquid was the principal fuel involved. Private fire protection, such as special extinguishing systems for rotating equipment, was absent in all cases.

In two of the three fires, the water supply for fire fighting failed when electrical energy to operate electric fire pumps was lost because of the fire. This experience emphasizes the need at electric generating stations for a reliable source of water that does not depend exclusively on the operation of the generating station.

Jan. 9, nr. Lawrenceburg, Ind. Indiana & Michigan Electric Co. $350,000.

Steam-electric generating station. The intermediate stage of a 90,000 Kw low pressure turbine was virtually ruined, mechanical and electrical equipment in the immediate vicinity of the turbine was severely damaged and the masonry, steel-framed building suffered relatively slight damage when the first stage rotor wheel of the turbine failed for mechanical reasons and a turbine oil fire ensued. Violent vibration that brought the rotor to a stop in less than 5 minutes broke oil pipe lines in the hydraulic gear case. Oil ignited immediately on contacting steam pipes and the turbine casing, and soon flames were extending upward 20 ft. and the generator room was filled with dense acrid smoke, driving everyone from the building. All power at the plant was shut off thereby stopping the emergency electric hydraulic oil pump and limiting the amount of oil pumped into the fire area to the 1,500 to 1,800 gallons discharged while the rotor was in motion. The fire gradually died down as the fuel was consumed and was finally extinguished, 1½ hours after start, with fire department foam streams. Water for the foam had to be re-

W. M. Krider

Jan. 9, nr. Lawrenceburg, Ind. Hydraulic oil was the fuel in this $350,000 fire.

layed 4,280 ft. from a public hydrant since loss of electric power at the plant stopped pumps supplying water to yard hydrants.

Mar. 2, Chats Falls, Ont., Hydro-electric Power Commission of Ontario, $1,000,000.

Hyrdo-electric generating station. Fire practically destroyed one of eight 23,500 KVA, 25 cycle, 13.2 Kv vertical generators, damaged or destroyed switches and other equipment on the circuit breaker gallery and caused severe structural damage to 140 ft. of the 520-ft.-long reinforced concrete building. The fire originated at an oil-immersed disconnecting switch in the circuit breaker gallery (15 ft. above generator room floor and 21 ft. beneath the concrete on unprotected steel-framed roof) and quickly spread to other oil-or asphalt gum-filled equipment in the gallery. Telephone wires were destroyed almost immediately, and in order to telephone for help, it was necessary for an employee to go by gasoline-powered railway car and automobile 1½ miles to the nearest telephone. An hour after the fire started a pumper arrived via road and railway trestle (the only access to the isolated plant) and placed two hose lines in operation shortly after the roof above the fire area collapsed. There was no equipment available for fire fighting prior to the arrival of the pumper. Venting of the fire through the collapsed roof permitted hose streams to be advanced within the building and used effectively to prevent more widespread damage. Fire damage was confined, for the most part, to the gallery and roof but collapse of the roof broke a governor on a generator. Oil escaping from the governor passed into the turbine pit, ignited and was drawn through the generator fans, thus burning out the stator winding. Investigation indicated that the fire originated at an oil-immersed disconnecting switch when switch blades overtraveled and grounded on the bottom of the oil tank. Since the blades were alive, arcs burned holes in the tank and ignited oil.

Ontario Hydro

Mar. 2, Chats Falls, Ont. One vertical generator at this hydro-electric generating station was practically destroyed by fire that originated at an oil-immersed disconnecting switch.

Dec. 30. Columbus, Wisc. Columbus Water & Light Co. $520,000.

Diesel-electric generating plant and water pumping station. An oil fire in the generating room of the 1-story building severely damaged five diesel engines. The fire was preceded by an explosion, originating in the crankcase of the middle engine of five diesels. The blast severed an oil feed line to an adjacent engine. Oil spraying up to the ceiling ignited and spread fire throughout the room. Flaming oil also spread to the basement through metal gratings in the first floor. During the 28½ hours when the town was without electricity there was no serious water shortage. Fire department pumpers pumped into the system during the first few hours of the emergency until a portable generator of sufficient capacity to operate the water pumps could be obtained.

Five Biggest Lumber Yard Fires – 1953

At least one substandard feature, and usually more than one, contributed to the extent of damage in each of the five lumber yard fires that involved losses of $250,000 or more in 1953.

NFPA Standards for Lumber Yards (Pamphlet No. 47)* call for watchman service whenever the yards are not in operation. Three of these five fires occurred during non-operating periods when no watchman was on hand. Pamphlet No. 47 emphasizes the importance of calling the fire department at once no matter how small a fire. In one instance employees fought the fire with portable extinguishers and did not give the alarm until the fire was beyond control. Pamphlet No. 47 prohibits smoking except in safe locations in buildings. One of the fires was believed caused by a cigarette carelessly discarded under a lumber storage shed. These are some of the substandard features responsible for the five large loss lumber yard fires last year.

*Copies available from NFPA Publications Service Department, 15 cents per copy.

***Mar. 16, Oaklyn, N. J. Suburban Lumber Co. $250,000.**

One-third of the lumber yard, including wooden sheds, was destroyed by fire discovered in a 1-story shed by employees. Instead of giving the alarm at once, they attacked the fire with portable extinguishers. Flames spread to a lumber lift truck causing the gasoline tank to explode and spread fire out of control before the fire department was notified.

***Apr. 25, Cicero, Ill. John Brennan & Co., et al. $250,000.**

A fire, believed caused by a carelessly discarded cigarette, originated under the floor of a lumber storage shed in a remote corner of the large lumber yard. Before detection, the flames, spurred by 30-mile-per-hour winds, had completely involved the two-story structure. Employees called the Cicero Fire Department who sent immediate calls for help from Chicago and Berwyn because they knew that the congested yard would cause trouble and exposure conditions were severe. Through the combined efforts of the three departments over 50 per cent of the yard-stored lumber was saved and only

*Fire spread to other structures.

Cicero Fire Department

April 25, Cicero, Ill. A cigarette carelessly discarded beneath a lumber shed in a remote part of the lumber yard was believed responsible for this $250,000 fire. The lumber yard office building at right and the dwelling at left were among the buildings in the path of wind-driven flames.

Associated Press Wirephoto

Aug. 16, Cleveland, Ohio. The threat to exposed buildings is usually present in lumber yard fires. Residents of 100 nearby dwellings were evacuated when fire swept through this yard. That none of the dwellings was burned was due in part to a masonry wall erected along one side of the lumber yard. The wall had been built following a previous fire that had spread through several exposed dwellings.

Arthur N. Hough

Sept. 3, Newell, Iowa. Because of the highly combustible contents of lumber yards it is vital that any fire be detected and controlled promptly. Watchman protection is also necessary to prevent unauthorized entry. Boys playing with matches and gasoline set this fire while the yard was not operating and was without the protection of a watchman.

one exposed cottage, situated adjacent to the yard and directly in the path of the strong wind, was lost. The telephoned alarm was received at 10:45 A.M. The $250,000 loss was slightly over the value of the buildings and contents involved.

***Aug. 16, Cleveland, Ohio The Dougherty Lumber Co., et al. $2,000,000.**

Planing mill, sash and door warehouse, office, two lumber sheds, 132,000 sq. ft. lumber yard. Fire that originated in the undivided and unsprinklered 87,000 sq. ft. 2-story brick, wood-joisted kiln building burned until all combustible material in the congested 15-acre yard was consumed. The fire originated during a non-operating period and since no watchman or automatic protection was provided, discovery was delayed and details as to exact origin remain unknown. The alarm was transmitted by a cruising police officer at 3:32 A.M. and when apparatus arrived the main building was totally involved. Additional apparatus was immediately summoned and 100 nearby dwellings were evacuated as fire spread to lumber piles and storage sheds. Yard hydrants yielded a poor supply of water and in many cases were inaccessible due to heat. Pumping units took up positions at hydrants considerable distances from the yard but here again water supplies were poor and by the time third alarm apparatus had arrived some 2½-inch hose had to be replaced by 1½-inch to get better distribution of the depleted water supply. Exposed dwellings were saved by masonry walls erected along one side of the yard. The walls had been built following a previous fire at the yard that destroyed several dwellings.

***Sept. 3, Newell, Iowa Fullerton Lumber Yard, et al. $275,000.**

Lumber yard, grain elevator, 3 freight cars. Boys playing with matches and gasoline set fire to the lumber yard that was left without the protection of a watchman during non-operating periods. The fire had made considerable headway before discovery by a neighbor at 5:00 P.M. and had engulfed the yard when apparatus arrived. A few records were removed before the yard's concrete block office building was destroyed. Absence of outside sprinklers allowed fire to enter and destroy a seriously exposed wood-frame, metalclad elevator containing 50,000 bushels of corn, oats and soybeans.

***Sept. 7, Houston, Texas Farrar Lumber Co., Inc. $350,000.**

Two million board feet of lumber, 5 sheds, office. Failure to provide watchman protection during holiday weekends allowed fire, possibly set by boys, to spread beyond control in the 90,000 sq. ft. lumber yard before discovery by neighbors at 1:00 P.M. Wood-frame, metalclad buildings on all sides of the yard delayed the discovery of the fire.

*Fire spread to other structures.

Large Loss Fires in Garages – 1953

Four of the more than 20,000 garage fires in 1953 caused approximately 5 per cent of the total garage fire loss. From the point of view of dollar values subject to loss by fire, the four garages that suffered losses of at least $250,000 last year were similar to a large majority of the other garages in the United States and Canada. That more garages did not experience such disastrous fires may have been due to luck or, on the other hand, to intelligent application of the principles of fire prevention and protection for this class of property. The four case histories cited below are good examples of the results to be expected when certain fundamentals are ignored.

In the records of garage fires in the files of the NFPA, mishandling of flammable liquids was responsible for 60 per cent of the total experience, and faulty operating heating equipment, 13 per cent. It is, therefore, not surprising that of the three known causes of large loss garage fires this year, flammable liquids were involved in two and a faulty oil burner was responsible for the third. One fire originated in a paint spray room, another while gasoline was being drained from a vehicle fuel tank and a third when delayed ignition caused an explosion in an oil-burning furnace. In the fourth instance the garage was so much involved when the fire was discovered that no clue re-

mained to indicate a probable cause. Garage fire experience has shown that automatic protection and segregation of hazardous areas are necessary protection features. Three of the fires occurred when the garages were closed and unoccupied; in the fourth case, the fire was discovered promptly but was so intense that employees did not have an opportunity to use first aid equipment. In all instances the buildings were totally destroyed. Study these results just cited in the light of the following facts and the reasons that the losses were total become apparent. None of the four garages was sprinklered, none had automatic detection or watchman protection and in none were hazardous areas segregated by fire walls.

Mar. 11, Lynbrook, N.Y. Blake Ave. Garage $250,000.

Repair and storage garage. Explosion of an oil burner due to delayed ignition was the reported cause of fire that destroyed the unsprinklered 1-story brick, wood-joisted building. Fire spread rapidly through the undivided building as gasoline tanks on vehicles ruptured and added fuel to the fire. Twenty-nine trucks and passenger cars were destroyed.

***June 23, Willows, Calif. Motor Inn, et al. $350,000.**

Garage; plumbing, farm equipment warehouses; two stores, apartments. Three of five adjoining buildings were destroyed, and the other two suffered major damage in fire that was beyond control in the 1-story metal-clad garage when seen by outsiders at 1:20 A. M. Fire spread rapidly to two adjoining metalclad buildings and entered a 2-story brick, wood-joisted building in the rear through a connecting doorway and plain glass windows on the second story. The combustible roof covering of a fifth building ignited and when fire burned through into the rear part of the building, flames flashed over combustible fibreboard interior finish in the structure. Mutual aid responding from towns as far as 50 miles away are credited with preventing a major conflagration as no fire walls or major fire breaks stood in the path of the flames. Several buildings ignited by heat or sparks were saved by mutual aid companies. A "walkie-talkie" operator was stationed on the roof of the tallest building to report fires started by sparks.

*Fire spread to other structures.

June 25, Baltimore, Md. Baltimore Motor Coach Co. $500,000.

Bus maintenance and storage. The need for extreme care in handling gasoline was emphasized by this fire that destroyed the 1-story brick, steel-framed garage and 15 buses. In some as yet unreported manner, gasoline ignited as it was being drained into an open container from an auxiliary fuel tank on a bus. Since there were no sprinklers or fire walls, fire spread rapidly to all parts of the building, intensified by gasoline released from exploding bus fuel tanks.

Baltimore News-Post

June 25, Baltimore, Md. Mishandling of flammable liquids, responsible for 60 per cent of all garage fires, was the cause of this $500,000 fire in a bus garage. In this instance gasoline ignited while being drained from a bus fuel tank into an open container.

Dec. 5, Innisfail, Alta. Kangiesser Motors $475,000.

Automobile sales and service. At 1:40 A.M. an explosion occurring in the paint spray room brought fire fighters to this fire in a 1-story, wooden garage. Firemen just about had the fire under control when a second explosion occurred that ruptured a ceiling partition and permitted fire to enter the concealed space between the ceiling and roof and spread to the main repair section of the building. It is presumed that the first explosion was caused by ignition of paint vapors by an electric spark. A loose connection on the vent fan motor had been giving trouble throughout the day. In the opinion of the fire chief inadequate pumping facilities prevented his men from extinguishing the fire before the second explosion occurred.

$765,000 Loss in Three Church Fires in '53

Three church fires, each with a loss in excess of $250,000, occurred during 1953. In addition, there were more than 3,000 other fires in churches, which, although less spectacular as regards monetary loss, in many cases put an additional strain on the funds of churches of almost every denomination.

The causes of the three large loss fires and the factors responsible for the sweeping destruction fall into a pattern long associated with church fires and this has been spelled out in detail in the NFPA pamphlet "Churches Are Burning."* Anyone with a personal interest in the preservation of church property is urged to review this pamphlet.

Jan. 12, St. Charles, Mo. This fire originated in the basement and had spread over varnished knotty pine interior finish before discovery by a passerby.

Jan. 12, St. Charles, Mo. Fifth Street Methodist-Episcopal Church $265,000.

Church with classrooms and kitchen. At 6:45 P.M., an hour after the janitor had lit three gas heaters in the basement, fire was discovered by a passerby. By then it had spread over the varnished knotty pine interior finish to most of the basement. Although heat and fire prevented effective use of a solid stream, indirect attack with water spray was not tried. No fire was visible in the auditorium but heat was intense, and a short time after firemen arrived a fire gas explosion blew out three walls and collapsed the roof. (See photo at left.)

*Copies available from NFPA Publications Service Department, $1.00 per copy.

Newark Evening News

July 5, Newark, N. J. Delayed detection is usually the case with church fires, that is, in those churches without watchmen or automatic protection. When this fire was discovered the auditorium was a mass of flames.

July 5, Newark, N. J. St. Bridget's Roman Catholic Church $250,000.

The first of four suspicious fires in church property in Newark within five days destroyed the 66-year-old unsprinklered brick, wood-joisted church. When discovered at 4:45 P.M. by a priest in the adjoining rectory the auditorium was a mass of flames. Heavy wood doors held back fire from adjoining wings housing a school and the rectory long enough for hose streams to be placed in position to prevent fire from entering these exposures through connecting doorways. However, heat damaged rooms in both wings which were separated from the church by 5-ft. alleys.

Aug. 23, Cleveland, Ohio Hough Avenue Baptist Church $250,000.

The church auditorium and roof were destroyed and classrooms in the rear were damaged by fire that originated in a pipe tunnel beneath the rostrum in which blower pipes from the basement to the organ were installed. A fault in organ wiring was the probable cause. The fire had made great headway when discovered by police at 4:56 A.M. and had entered the classroom section of the building because a fire door had been left open.

March 2, Syracuse, N. Y. Unprotected openings were the means of vertical fire spread in each of the ten large loss fires in multistoried residential buildings in 1953. This fire originated near the foot of an open elevator shaft.

Hotels, Other Large Residential Fires, '53†

In the eleven large loss fires to occur in occupancies used primarily for residential purposes seven persons lost their lives and the estimated total loss was $4,463,000. Thus, the 1953 large loss fire experience was an improvement in all respects over the residential record of 1952 when there were thirteen large loss fires resulting in nine deaths and $7,442,000 damage.

Five of the deaths occurred in two hotel fires and two in an apartment fire. In every instance the victim was trapped (one jumped and sustained fatal injuries) because of inadequate exits.

As in 1952, hotels suffered the most large loss residential fires. There were six in 1953, seven in 1952. Two apartment fires, one hospital, a mansion and a prison completed the 1953 list.

In eight of the fires the cause was not determined. Two fires were set, and one was attributed to defective wiring.

†See also pages 287, 291-292 for apartments over stores.

Remembering that all of these fires involved buildings in which people lived, it was disturbing to note that many of those features of construction and private protection normally considered essential for life safety in combustible residential buildings were missing. None of the buildings was sprinklered; none had automatic detection protection; in seven cases no watchman was provided and in another the service was substandard. There were no fire brigades.

Construction weaknesses were responsible for the fact that in every multistoried building, fire spread to more than one story. All buildings were combustible and therefore not only the contents but also the building itself contributed fuel to the fire. In eight of the ten fires in multistoried buildings flames spread vertically through open stairways, open elevator shafts or both. In one case fire spread via a pipe shaft and in the other within nonfirestopped walls.

Apartment Buildings

Mar. 2, Syracuse, N. Y. Mowry Building $296,000.†

38 apartments, 6 stores. The fifth and sixth stories and roof were destroyed by fire that originated near the base of the elevator shaft of the unsprinklered 6-story brick, wood-joisted building. Fire spread up the open shaft and mushroomed at upper floors before discovery by passersby at 7:27 A.M. Fire department ladders were used to rescue several of the 100 occupants who escaped safely. Twenty fifth-story occupants escaped down a fire escape to the roof of an adjoining building.

***Dec. 28, Holyoke, Mass. Mary Jacobson, et al. $400,000, 2 Killed.**

Apartments, lodging house, hardware, television, clothing stores. Two occupants of apartments in the unsprinklered 25,000 sq. ft. 4-story brick, wood-joisted building of origin were missing and believed killed and twelve were hospitalized in fire that was beyond control when discovered by a policeman at 4:00 A.M. The fire originated in rubbish in the rear alley, entered the first story through plain glass windows and spread vertically through open stairwells. Lack of parapets on fire walls allowed fire to spread to the buildings on either side.

*Fire spread to other structures.

Hospitals

May 1, Mt. Airy, N. C. Martin Memorial Hospital. $291,000.

75-bed general hospital. All 54 patients were removed to safety by hospital personnel and volunteers as fire spread throughout the attic of the unsprinklered 2-story wood-framed, stone veneer building. A high pressure steam pipe may have been the cause of the fire that originated within a wall at the second story level where it was heard by a nurse at 7:00 P.M. As the fire department responded and evacuation of patients was begun, flames spread within the nonfirestopped wall to the attic where combustible supplies and ether were stored. The roof was soon in flames and eventually fire spread to the second story through an open dumbwaiter shaft. An explosion in the attic during the fire is attributed either to ignition of fire gases or rupture of an ether container.

Hotels

***Mar. 2, Old Town, Me. Fransway Hotel, et al. $250,000.**

Hotel, bowling alley, garage, lodge hall. With a few substandard fire walls the only structural barriers to spread of fire through the congested combustible buildings in the center of the business district, the prevention

†Includes business interruption loss.

March 2, Old Town, Me. Although this scene is spectacular and accurately pictures the intensity of the fire it does not show the outstanding feature, namely, the operation of outside sprinklers on several exposed buildings to prevent a conflagration.

March 30, Atlantic City, N. J. Open stairways and elevator shafts almost proved fatal for four occupants in this unsprinklered 7-story hotel. Most of the guests were able to escape before open halls, stairways and elevator shafts filled with smoke and heat. However, three guests and a maid were trapped on a seventh story window ledge until rescued over aerial ladders.

of a fire of conflagration proportions was due primarily to the effective operation of sprinklers. The fire originated in the pin refinishing room of a bowling alley in the first story of an unsprinklered 4-story wooden hotel, and because of an unexplained delay in fire department operations, had burned through a wooden door that opened into an open stairway before weak direct-hydrant-connected hose lines were in use. Occupants of the hotel had been alerted in time to leave the building before the stairway became impassable. Fire extended rapidly to two adjoining unsprinklered wooden buildings but further spread to seriously exposed wooden buildings was checked by sprinklers. Manually controlled outside sprinklers saved one adjacent 2-story building, inside sprinklers kept fire damage to a minimum in a second, and operation of automatic outside sprinklers kept wind-driven heat and embers from igniting a third 2-story wooden building across a street.

Mar. 30, Atlantic City, N. J. Strand Hotel $640,000.†

270-room hotel. Fire originating on the fourth floor in an unoccupied guest room spread rapidly through the unsprinklered 7-story brick, wood-joisted building by way of open elevator shafts and stairways. Discovery was by the hotel manager at noontime. The fire department was called, all guest rooms were notified by telephone and employees went from room to room to empty the hotel. Most guests escaped before smoke and heat filled open halls, stairways and elevator shafts. However, three guests and a maid were trapped in the seventh story and were eventually rescued over an aerial ladder from a ledge on the seventh story.

†Includes business interruption loss.

April 19, Sioux City, Iowa. West Hotel $351,000.

65-room hotel annex with public restaurant. The concealed space above the kitchen ceiling of the first floor restaurant (not operating on April 19) was the point of origin of fire that destroyed 75 per cent of the roof and 60 per cent of the fourth story of the unsprinklered 4-story brick, wood-joisted building. The fire burned from the ceiling space up into a second story toilet room and thence into a combustible pipe shaft that extended to the attic. Flames spread up the shaft and mushroomed through the attic.

July 10, Fresno, Calif. Hughes Hotel, et al. $375,000.

Hotel, four stores. The most disastrous of 12 fires believed set by an arsonist within a

July 10, Fresno, Calif. This fire did not start on the roof or an upper floor, as might be inferred from the picture, but in a first story lavatory. It got from the lavatory to the attic, roof and third story by way of a light shaft.

2½-hour period in Fresno burned out a large part of the 52,000 sq. ft. 4-story masonry, wood-joisted hotel building. The fire originated in a lavatory on the first floor near a light well and spread through the light well to the attic, roof and fourth story. Fire did not involve the basement, the only part of the building that was sprinklered. First arriving firemen found 20 persons on upper floors from where they hesitated to descend through the stairwell rapidly filling with smoke and heat. These people were led down the stairway to safety. An hour and a half after the fire was detected, need for men and equipment at a serious apartment house fire, also set, required that only enough men and equipment be left on the hotel fire to hold it in check and protect exposures for several hours. Mutual aid was of vital assistance to Fresno.

***July 28, nr. Rosendale Twp., N. Y. Williams Lake Hotel $250,000, 4 Killed.**

Resort hotel. Four guests were trapped and killed and 14 injured in fire that originated in the second story of a 2-story wooden annex and was beyond control when discovered. Since the watchman had gone off duty at 4:30 A.M., the fire was not detected until seen by the engineer of a passing train at 5:45 A.M. Tied down locomotive whistles gave the alarm and are credited with saving the lives of many guests. Fire spread from the annex via a connecting breezeway to the

Aug. 29, Pueblo, Colo. The 5-story building shown here was adjacent to the 2-story hotel building where the fire originated. Flames entered the 5-story building through plain glass windows at the third story level.

*Fire spread to other structures.

main hotel. An automatic detection system was being installed.

***Aug. 29, Pueblo, Colo. Cosmopolitan Hotel, et al. $760,000; 1 killed.**

Three buildings housing 2 hotels, 10 stores, many offices. Fire originating in the hotel occupying the second story of an unsprinklered 60,000 sq. ft. 2-story brick, wood-joisted building spread into and destroyed an adjoining 16,800 sq. ft. 5-story stone, wood-joisted building and jumped a 16-ft.-wide alley and destroyed a 4-story brick, wood-joisted building. On being awakened by an explosion sometime after 3:00 A.M. the hotel operator found that the only guest had left. The building was so charged with smoke that he was unable to complete an alarm by telephone, being forced to leave the building and pull a fire alarm box across the street. Flames were coming from the roof when apparatus arrived and were entering the adjoining 5-story building through plain glass windows at the third story level. A large light well, combustible interior finish, including combustible fibreboard ceilings, and numerous open stair and elevator shafts hastened spread through this building. The 4-story exposure 11 ft. away was involved when heat entered through plain glass windows. An old man who slept in a room adjacent to his office in the 5-story building refused to leave on advice of the caretaker and was trapped.

Mansion

Feb. 1, Delhi, N. Y. Robert L. Gerry $250,000.

65-room mansion. All except the servants' wing consisting of 14 rooms was destroyed by fire that originated in the valet's room on the second story of the 3-story masonry, steel-framed building. Valuable paintings, rugs, furniture and books were among the furnishings destroyed. The watchman on discovery of the fire at 4:10 A.M., one hour and ten minutes after his regular tour, was unable to reach a telephone because of heat and smoke and drove more than a mile to another telephone. Firemen, confronted with a major fire because of delayed discovery and notification, were further hampered by poor water supplies from a 3-inch main.

Prison

***Aug. 20, Monroe, Wash. Washington State Reformatory. $600,000.**

Eight brick, wood-joisted industrial buildings were destroyed by fires set by 150 rioting boys who lighted gasoline-soaked rags and tossed them through windows. Unaware of the riot, Monroe firemen drove their apparatus into the main stockade but were immediately stoned and forced to leave. With manual fire fighting impossible, the unsprinklered buildings were destroyed.

*Fire spread to other structures.

July 28, nr. Rosendale Twp., N. Y. Four guests of this resort hotel were trapped and killed, 14 were injured when fire swept through the annex into the main hotel. The fire was detected by the crew of a freight train at 5:45 A.M., an hour and 15 minutes after the watchman had gone off duty.

Worst No. American Aircraft Fires – 1953*

Fire losses involving aircraft reported herein total $45,000,000 and these accidents cost 192 lives. Using the same basis for reporting in 1952, corresponding figures were $54,550,000 and 354. In 1953 there were 36 aircraft fires. In 1952 there were 41. It is, therefore, obvious that there was a decided improvement in the over-all record during the last calendar year.

In 1953 there were five civil air transport accidents, only 3 with fatalities, in the United States where fire was a decided influence in the loss of life or extent of property damage. These five totalled $4,500,000 in losses with 44 killed. In 1952, the corresponding experience was four accidents, only 2 with fatalities, with losses totalling $2,600,000 and 63 killed.

Military losses (all branch services in U. S. and Canada) in 1953 decreased from 37 (in 1952) to 30 and the loss of life decreased from 291 (in 1952) to 192. Offsetting this 66% reduction in loss of life on this continent was the world's worst aircraft crash which killed 129 Americans in Kodaira, Japan (near Tokyo) seconds after a C-124 Globemaster took off from the U. S. Air Base at Tachikawa en route to Korea. In a newspaper statement concerning this accident, a Japanese fireman said: "Seven of us rushed to the burning wreckage and pulled out seven dying men, all the others were trapped in the flames and we could do nothing."

Crash fires were most numerous and caused the greatest life toll as in previous years. In 1952 there were 250 killed in 21 crash fire accidents reported by the NFPA. Last year, there were 166 killed in 19 similar accidents. Fire in flight and airborne explosions were responsible for 11 fires in 1953 costing 26 lives. In 1952 there were 16 such incidents causing 104 deaths. Ground fires in 1953 destroyed two aircraft valued in excess of $250,000 as compared to 4 last year, and one of these two occurred at the end of a landing roll following a flight.

The fires reviewed herein are a very small sample of the aircraft fire experience of 1953 but were selected as being the major losses predicated on the $250,000 minimum established by the NFPA in its annual summary of "large loss fires." Omitted are a number of civil and military accidents where crash impact was primarily responsible for the loss of life and the extent of damage, as. for instance, the American Airlines crash near Albany, N. Y., on Sept. 16, 1953, fatal to 28. In this accident all deaths were caused by fractured skulls (according to a report by the Albany County coroners) and despite the fact that fire followed the final impact, fire obviously was not a major factor.

Jan. 7, near Issaquah, Wash. Flying Tiger Line, DC-4. $500,000, 7 Killed.

All seven occupants in a Flying Tiger Line Douglas DC-4 "ferry" flight from Burbank to Seattle were killed when the aircraft crashed in a range of hills while making a low frequency radio approach to Boeing Field, Seattle. The aircraft caught fire at first impact and continued to burn for several hours after finally coming to rest. The first contact was with a tree but the aircraft continued flying until it struck the ground in a canyon 1500 feet below. The fire destroyed a considerable portion of the aircraft but no evidence was found to indicate fire, structural failure or malfunction of the aircraft or its components prior to impact with the tree. The CAB investigation determined that the probable cause of the accident was deviation from the established approach procedures to Boeing Field.

Jan. 13, near Gridley, Calif. U. S. Air Force, B-29. $750,000, 11 Killed.

Marshy land made almost inaccessible the location of this crash and there were no survivors among the crew of 11 men aboard. An explosion and fire enveloped the wreckage denying escape of the occupants.

*See also page 253 for aircraft fire in manufacturing plant.

International News Photo

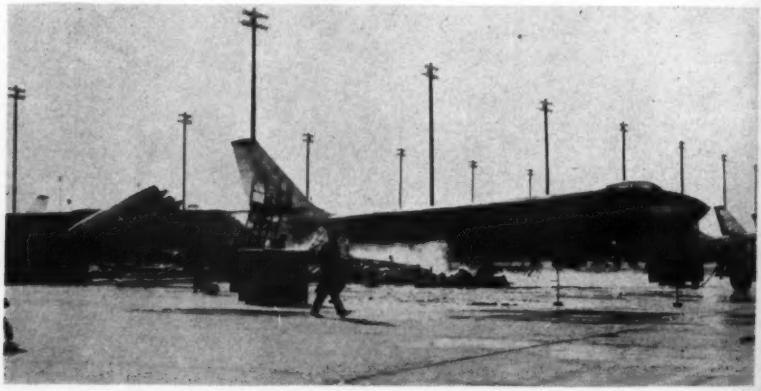
Jan. 22, Burbank, Calif. Fire fighters could not control this Constellation crash fire at Lockheed Air Terminal with available fire equipment. Despite the fact that the fire was instantaneous, ten occupants escaped.

Jan. 16, near Harmon Air Base, Nfld., U. S. Air Force, C-54. $500,000, 13 Killed.

Residents of a nearby community were first aware of this crash when a flash lit up the sky. Misty rain was falling at the time and the accident occurred about a mile from the Air Base just before a landing attempt. All 13 aboard were killed in the burning military transport version of the DC-4.

Jan. 22, Burbank, Calif., Intercontinental Airways, Constellation. $1,000,000.

During a training flight, the pilot failed to extend the landing gear while making an attempted landing at the Lockheed Air Terminal. With the wheels-up impact, fire originated in No. 2 and 3 engine nacelles, presumably due to the sudden stoppage of the powerplants by the ground contact of



Feb. 21, Wichita, Kans. The wreckage of parts of two B-47's that burned following a static spark ignition of JP-4 fuel during ramp servicing. One B-47 was being given a high level fuel check when the fire occurred.

the propellers. All 10 occupants of the burning aircraft escaped but the fire equipment available was unable to cope with the intensity of the fire and the aircraft was totally destroyed within the next hour. Foam or carbon dioxide was not available in quantity to handle the fire emergency.

Jan. 30, near Hunter Air Force Base, Ga., U. S. Air Force, B-50. $850,000, 4 Killed.

Four airmen were killed when a B-50 crashed and burned just after take-off from the Hunter Air Force Base. The plane did not gain an altitude of over 50 feet when it faltered, clipped off the tops of trees and crashed just some 100 yards from the end of the runway. Six crew members were hurled from the aircraft at the impact and were thus clear of the serious fire area. Three of these men survived and two of them escaped with only minor burns. Machine gun bullets detonated in the wreckage as the aircraft burned but did not injure rescue workers.

Feb. 12, near Goose Bay, Labrador, U. S. Air Force, B-36. $3,500,000, 2 Killed.

A B-36 with 17 aboard crashed and burned near Goose Bay on a return flight from England. Two were killed in the accident as the ten-engined bomber attempted to land at the Goose Bay Airport and crashed in deep snow 16 miles from its goal.

Feb. 18, Walker Air Force Base, N. M., U. S. Air Force, B-36. $3,500,000.

Two engines on a B-36 burst into flame as the aircraft neared the end of its landing roll at this Air Force Base. Twenty-two crew members and airmen leaped to safety without injury. A member of the Air Base Fire Department is credited with entering the burning aircraft to make sure all had deplaned as darkness obscured positive indication that there was none aboard. Fire control could not be established by fire fighters and the entire aircraft was destroyed.

Feb. 21, Wichita, Kansas, Boeing Airplane Company, B-47. $3,000,000.

Static electricity is blamed for a fire that ignited JP-4 fuel during ground servicing of a B-47 on the flight apron at the Boeing Airplane Company's Wichita plant. The static was apparently generated by the flow of fuel through the delivery hose and the vapors present around the fuel filler neck were ignited. An explosion within the tank of the B-47 followed which caused a large volume spill (over 2,000 gallons) of the jet fuel and a serious fire. One man on the wing suffered second degree burns before getting clear of the fire area. One B-47 was almost totally destroyed and a second B-47 was damaged. Air Force type crash trucks used carbon dioxide, foam and chlorobromomethane in gaining control but had trouble with the magnesium gear assemblies which continued to burn after the JP-4 fuels had been extinguished.

Mar. 20, Alvarado, Calif., Trans-Ocean Air Lines, DC-4. $500,000, 35 Killed.

The four engine DC-4, en route with service men aboard from Roswell, N. M., to Oakland, crashed and burned, as it circled a hill in making its approach for landing. An eye witness reported seeing passengers with their clothes on fire trying to evacuate the fuselage but none succeeding in escaping. The aircraft burned for some time after the crash, the location being inaccessible to fire fighting equipment. On Aug. 24, 1951, a United Air Lines DC-6 crashed in the same location. Trans-Ocean Air Lines is a large non-scheduled air carrier. The CAB could not determine the cause of the accident other than apparent loss of control during descent.

Mar. 26, near Wichita, Kans., U. S. Air Force, B-47. $3,000,000, 3 Killed.

A B-47 Stratojet bomber crashed and burned while trying to land at the Wichita Air Force Base killing all three fliers aboard. Fire broke out on first ground contact and the crew were trapped in the fuselage..

Apr. 23, near Seattle, Wash., U. S. Air Force, KC-97. $1,500,000, 1 Killed.

All ten authorized crew members of this fuel tanker type aircraft parachuted to safety after one engine exploded in flight a few minutes after leaving Boeing Field. The explosion knocked away large sections of control surfaces and the pilot ordered the crew to bail out after nursing the four-engine plane to 5,000 ft. and setting the automatic pilot. A stowaway was killed in the ensuing crash. The body was found in the tail section. The aircraft struck the ground in a wooded, uninhabited area.

Apr. 29, near San Antonio, Texas, U. S. Air Force, B-29. $750,000, 10 Killed.

Fire in flight was responsible for this accident fatal to 10 of 15 crew members aboard the B-29. The Randolph Field control tower received a radio message at 8:35 A.M. that a fire had broken out but that was the last word received. Five crew men were able to parachute to safety before the big plane smashed into the ground. Cause of the fire has not been released.

May 12, near Niagara Falls, N. Y., U. S. Air Force, X-2 Rocket. Over $1,000,000, 2 Killed.

Bell Aircraft Corp.'s top secret X-2 research rocket aircraft exploded while being carried aloft by a B-50 "Mother" plane. A test pilot and engineer parachuted from the bomb-bay of the mother plane but their bodies had not been found at last report. The explosion demolished the 1,000-mile-per-hour experimental aircraft during tests of pressure and rocket fuel systems prior to launching from the B-50. The accident occurred at 30,000 ft. over Lake Ontario. The X-2 broke loose from the bomber and crashed into the lake.

May 12, near Sargent, Neb., U. S. Air Force, B-29. $750,000, 9 Killed.

Three occupants walked away from a burning B-29 which crashed from a low altitude on a farm near Sargent. Nine others perished in the flaming wreckage. The three survivors were all located in the tail section of the four engine bomber.

May 19, near Crystal Lake, Ill., U.S. Air Force, F-86D. $700,000.

The pilot of a Sabre jet parachuted to safety just before his plane exploded in flight at 10,000 ft. altitude. The explosion was preceded by fire in the jet engine. The pilot evacuated the burning aircraft by using his ejection seat when he determined that the fire was uncontrollable. His parachute opened and he landed in a tree and was able to jump to the ground without a scratch.

June 2, near Richmond, Me., U.S. Air Force, F-84. $500,000.

An explosion in flight forced the pilot of an F-84 Thunderjet to parachute to safety when near Richmond. The aircraft fell in several sections, parts being scattered over a four-mile area. The pilot landed safely on an island in Casco Bay.

June 3, Mountain Home, Idaho, U.S. Air Force, B-29. $750,000, 1 Killed.

Only one crew member of 14 was killed in an emergency landing attempt at the nearby Air Force Base. The B-29 struck the ground about 3½ miles from the end of the runway. The pilot was apparently injured by the impact and could not evacuate with the rest of the crew before flames swept the fuselage. Air Base fire equipment rushed to the scene but the wreckage burned for almost three hours.

July 7, near Chestertown, Md., U.S. Navy Constellation. $1,000,000, 6 Killed.

Fire in flight was responsible for six deaths in this crash of a Navy Transport Squadron Constellation. The burning aircraft struck the ground about twenty feet from a group of workmen building a new house but none of them was injured seriously. They attempted to rescue occupants but the heat was so intense they could not get close enough. One of the crew was thrown clear at ground impact but his injuries were fatal.

July 10, Charleston, Air Force Base, S.C., U.S. Navy Neptune. $250,000.

A crew of eight scrambled to safety seconds before fire broke out in this Navy Neptune bomber after the landing gear collapsed following touch down at the Charleston Air Force Base. Fire fighters were unsuccessful in saving the damaged aircraft despite efforts to blanket the aircraft with foam.

July 17, near Milton, Florida, U.S. Marine Corps., Fairchild Packet. $250,000, 44 Killed.

The worst continental air disaster of 1953 occurred when a Marine Corps Fairchild Packet (C-119) crashed on take-off from Whiting Field and "burst into a rolling ball of fire" before striking three parked automobiles and a barn. Five men of the total of 46 originally survived but three of these subsequently died of burns suffered in the accident. Most of the passengers were R.O.T.C. students who had been undergoing summer training and 22 of these were students from the University of Oklahoma. No details on the cause are available.

July 29, near O'Neill, Neb., U.S. Air Force, H-18. $250,000, 6 Killed.

All six passengers and crew members aboard an Air Force helicopter were trapped by fire when the H-18 crashed during a weather research flight near O'Neill, Nebraska. It appears that one blade of the center rotor came off in flight and struck the rear balancing rotor. The 6,200 pound helicopter was only 15 or so feet above the ground but the resultant fire prevented escape by any of the occupants. A noted scientist and a Korean war hero were among those burned to death.

Aug. 3, near Elgin, Texas, U.S. Air Force, KB-29. $1,000,000.

Parachutes saved the lives of all 12 crewmen aboard a KB-29 which fell out of the

July 17, Milton, Fla. A group of R.O.T.C. students were killed in this crash which took a total of 44 lives and was thus the worst U. S. accident of 1953. The Fairchild Packet burst into flames at first ground contact and then hit 3 automobiles and a barn.

sky, crashed and burned about 4 miles from Elgin. The KB-29 is a flying jet fuel service station for jet fighter refueling in flight. No explanation of the accident has been released.

Aug. 11, Ville Jacques Cartier, Quebec, Royal Canadian Air Force, CF-100, $500,000, 9 Killed.

A crippled RCAF twin-jet fighter, CF-100, crashed into and set fire to a row of suburban homes, taking nine lives. The aircraft first struck a power line and was apparently on fire before it collided with the dwellings. Both crew members were killed and, in addition, seven occupants of the dwellings, including five children. Flames quickly consumed the tangle of broken dwellings. It appeared that the pilot was attempting to reach a field about 200 ft. from the point of impact. Security restrictions prevent the release of further information.

Aug. 12, Westover Air Force Base, U. S. Navy R6D. $1,000,000, 4 Killed.

Four Navy airmen were killed when a Douglas R6D, the Navy version of the DC-6B, crashed and burned at take-off. The aircraft reached an altitude of approximately 200 ft. and then veered suddenly to the right, losing altitude. The wing tip touched the ground, the transport cartwheeled and flames broke out instantaneously. Propeller reversing is suspected to have been the cause. Fire fighters were quickly on the scene but could not reach the trapped occupants in time. The aircraft was assigned to a Naval Transport Squadron attached to the Military Air Transport Service. It is fortunate that the aircraft was on a training flight and did not carry its normal complement of 64 passengers.

Aug. 20, near Picacho, Ariz., U.S. Air Force B-50. $850,000, 2 Killed.

An airborne explosion preceded by a fire in No. 3 engine of a B-50 at 15,000 ft. forced the crew to bail out. Ten parachuted safely, one was unable to clear the aircraft and a second fell to his death when his chute was torn. The aircraft crashed into the Arizona desert and burned.

Sept. 6, McChord Air Force Base, Wash., Eastern Air Lines and Northwest Airlines, Super Constellation, $1,250,000.

An Eastern Air Lines Super Constellation, leased to Northwest Airlines, crashed and burned while making an emergency landing at McChord Air Force Base. The emergency was created by the loss of power in engines 3 and 4 and the loss of hydraulic pressure after take-off from the Seattle-Tacoma Airport for Chicago. Air Base Fire Department equipment, under the supervision of Chief A. J. McCarthy, had been alerted by the control tower and was on

stand-by duty when the aircraft touched down about 4,000 ft. from the end of the runway. Gear failure followed, throwing the left wing to the runway and ultimately dragging the aircraft off the pavement. A large spill of fuel occurred simultaneously with the impact and at least 3,500 of the 4,300 gallons of the fuel aboard were consumed in the fire despite prompt fire control.

The "combined agent" technique of crash fire fighting, recommended by the NFPA in Standard No. 403, was used. Foam was applied by the crash truck turret, in the area of the rear cargo door through which 26 passengers made their escape. Hand lines of foam were used around the fuselage door. Low pressure carbon dioxide (6,000 pounds) was used to control the severe fire in the area while two other foam trucks blanketed the burning fuel spills with foam and also blanketed both sides of the fuselage. Additional water supplies were furnished the crash trucks from pumpers relaying from the nearest hydrant 800 feet away. Limitations in personnel and lack of complete radio equipment on the emergency apparatus were handicaps in the full utilization of the available equipment. Tacoma and Lakewood fire departments sent three pumpers and 14 men to the scene. Total time required to accomplish total extinguishment was 30 minutes. Only 2 of the 30 occupants suffered major burns and 21 had no burns at all including the 4 crew members who evacuated through the right front cabin escape hatch.

Sept. 8, near Panama City, Fla., U.S. Air Force, F-86D. $700,000, 1 Killed.

The pilot of an F-86D Sabre jet was killed following a mid-air explosion over Panama City. Wreckage was showered over the ground, parts landing on a housing project and the junior high school.

Oct. 2, near Presque Isle, Me., U.S. Air Force, F-89. $1,000,000, 2 Killed.

Both crew members of an F-89 Scorpion were fatally burned in the crash of their interceptor a few miles from the Presque Isle Air Force Base. The jet had been in contact with the tower only a minute before the crash and no explanation is available as to the reason for the accident.

Oct. 14, March Air Force Base, Calif., U.S. Air Force B-47, $3,000,000, 3 Killed.

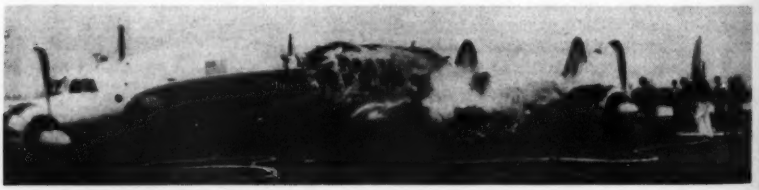
On take-off, a B-47 crashed with fatal injuries to all three crew members aboard. No details on the accident were released by the Air Force.

Oct. 14, Edwards Air Force Base, Calif., U.S. Air Force, X-5, Over $1,000,000, 1 Killed.

One of the two existing Bell X-5 research planes crashed on a test flight fatally injuring the test pilot. No details on the accident are available.

Oct. 19, New York International Airport, Jamaica, N.Y. Eastern Air Lines, L-49 Constellation. $1,250,000, 2 Killed.

At approximately 12:56 A.M. an Eastern Air Lines Constellation, outbound for Puerto Rico with 27 persons aboard, attempted to take off on an 8,000 ft. runway at New York International Airport. For reasons still under investigation by the Civil Aeronautics Board, and others, the aircraft became airborne for only split seconds and then contacted the ground in a sandy area approximately 4,000 ft. in lineal measurement from the point where the aircraft started its take-off run. The No. 3 engine became dismounted as the aircraft skidded across the sandy terrain. Fire broke out immediately as wing tanks ruptured. All of the esti-



A P Wirephoto

Sept. 6, near Tacoma, Wash. This Constellation crash fire was extinguished by the McChord Air Base Fire Department using the combined agent technique of carbon dioxide and foam. The 30 occupants escaped through a foam path despite a large spill of fuel instantaneous with the collapse of the landing gear. Wing structural members containing the fuel also support the landing gear on this aircraft.

United Press Photo

Oct. 19, Jamaica, N. Y. First fatal Constellation crash fire in the U. S. occurred Oct. 19, 1953 at New York International Airport. Fog in the airport delayed response by fire equipment as ground visibility was so bad even the airport control tower could not spot the exact location on the big airport.

mated 4,200 gallons of gasoline aboard were consumed. All 27 occupants were able to deplane without loss of life although one passenger died of crash injuries and a second, attempting to return to the burning aircraft, sustained fatal burns.

Crash equipment was delayed 6½ minutes reaching the scene because of fog and atmospheric smoke which had reduced surface visibility from 1/16 to 1/4 mile on the airport during the emergency. Even the control tower did not know the exact location of the crash at the time of the first alert. The Port of New York Authority used their Walter-Maxim emergency truck, backed up by its "nurse" truck, a modified Class 155 and a second "nurse" truck. (Nurse trucks are water tankers with auxiliary foam supplies.) Nine pieces of fire apparatus were also dispatched by the City of New York fire department. The 8,000 gals. of water available on airport equipment were used and refills made from a hydrant 4/10ths miles from the scene. A rescue path was laid to the cabin door with fog-foam and the fire in the fuselage and left wing were extinguished with the fog foam. Carbon dioxide was used with fog foam to extinguish the fire in the ruptured wing tanks. The magnesium fire in No. 1 engine resisted all extinguishing efforts including a special powder agent.

Oct. 27, nr. Falmouth, Mass. U. S. Air Force, F-94C. $700,000.

The pilot and radar observer of an F-94C Starfire jet fighter plane bailed out following a mid-air explosion. The wreckage was never found and it is presumed to have dropped into the ocean.

Nov. 14, nr. Spokane, Wash. U. S. Air Force, F-86D. $700,000.

Fire fighters at Geiger Field were on the scene quickly when an F-86D Sabre jet crashed and burned on take-off. The pilot escaped unhurt. Reports indicate that the canopy on the cockpit loosened on the take-off run and the pilot attempted to halt the aircraft's progress. The landing gear collapsed and the plane skidded off the end of the runway, bounced over a railroad embankment and burned. The fire fighters extinguished the flames, originating in the tail section, with foam.

Dec. 3, nr. Tucson, Ariz. U. S. Air Force B-47. $3,000,000, 4 Killed.

Newspaper reports advise that a B-47 Stratojet burst into flames and crashed in the Santa Catalina Mountains 25 miles east of Tucson killing all four men aboard.

Dec. 11, nr. El Paso, Tex., U. S. Air Force, B-36. $3,500,000, 9 Killed.

While maneuvering for a second landing approach to Biggs Air Force Base, a B-36 smashed into the side of Franklin Mountain and exploded into flames. All 9 aboard were killed. The fire was most intense and despite poor visibility, could be seen at great distances. A mix-up in landing in-

Dec. 18, Ogden, Utah. This B-29 burned after overrunning the Ogden Municipal Airport and skidding across a busy highway. One crew member died in the flames but seven were rescued and hospitalized.

structions or incorrect directions were blamed by local newspapers for the accident but no verification has been issued.

Dec. 18, Ogden, Utah, U. S. Air Force, B-29, $750,000, 1 Killed.

Landing at the Ogden Municipal Airport, a B-29 radar calibration plane crashed and burned after it "ran out of runway," careened through a ditch, broke off a wing, skidded across a highway and ground looped in an adjoining open field. Only one crew member was killed, the co-pilot. Seven others were pulled from the flaming wreckage by passersby on the highway, two with serious injuries.

Other Transportation Fires

Automobiles, ships and railroad rolling stock were involved in many fires during 1953. A large number of the automobile fires involved loss of life, particularly those in which fire followed collision or overturn. The ship fire incidents were more numerous than the two reported herein would indicate but those which occurred most frequently and involved loss of life occurred in small power boats whose dollar value, as in the case of automobiles, is substantially below the $250,000 minimum used in this particular NFPA study. The *Leyte* disaster, reported herein, shows the importance of engineering for fire safety, as well as for performance, in shipboard equipment.

Ships

June 5, Delaware Bay, off Wilmington, Dela. National Bulk Carriers, Inc. $12,000,000, 4 Killed.

14,179 gross ton tank ship *Phoenix;* 11,081 gross ton tank ship *Pan Massachusetts.* A navigational error aboard the empty *Phoenix* was apparently responsible for collision of the two tank ships that left the bow of the *Pan Massachusetts* impaled in one side of the *Phoenix.* The *Phoenix* had previously carried a load of crude oil but was empty at the time of the collision; the *Pan Massachusetts* was carrying 160,000 bbls. of gasoline. Three violent explosions, one at the time of the collision, in the tank of the *Phoenix,* eventually split the *Phoenix* in two after which the sections sank.

A Navy fire-fighting team was instrumental in putting out the fire that occurred immediately aboard the *Pan Massachusetts.* After the vessel was cooled with water, most of the fire above deck was blanketed with foam discharged from a tug. A boarding party then attempted to complete extinguishment. Before this was successful the foam supply was exhausted and fire fighting was delayed four hours until the supply was replenished.

Four crewmen from the *Phoenix* lost their lives. That more of the 86 crewmen of the two ships were not killed was due in part to rescue work by owners of small boats who circled the ships to pick up survivors.

June 5, Delaware Bay, Dela. Another tank ship fire in the Delaware cost 4 lives. Two such incidents were reported last year in the January 1953 Quarterly, page 243.

Oct. 16, Boston, Mass. U. S. Government, Dept. of Navy $600,000, 37 Killed.

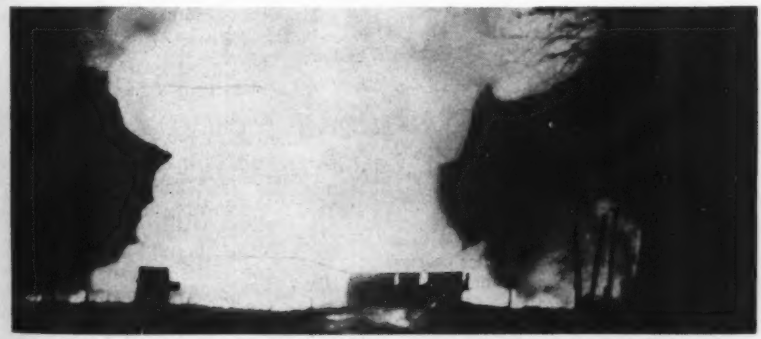
27,500-ton aircraft carrier *Leyte*. Ignition of flammable hydraulic fluid, accidentally released under pressure of approximately 2,700 psi, was the cause of a flash fire that killed 37 navy and civilian personnel and injured 39, according to unofficial reports. The fire originated and was, for the most part, confined to the port catapult machinery room under the hangar deck, forward.

According to reports released to newspapers the court of inquiry found "no intent, fault, negligence or inefficiency of any person in naval service or connected therewith." Sabotage was also ruled out. The report concluded that someone injected air under high pressure into a small tube that contained oil, generating sufficient heat to ignite the oil.

Railroad Rolling Stock

Mar. 28, Lewis, Ind. Chicago, Milwaukee, St. Paul and Pacific R.R., et. al. $500,000.

Seventy-five dwellings and mercantile buildings were destroyed or badly damaged by an explosion that followed derailment of a freight train passing through the town. Two carloads of bulk explosives and one carload of rounds of fused ammunition were in the train. Several small explosions occurred, presumably individual rounds of ammunition, prior to the blast that caused most of the destruction. Survival of the 300 residents is accounted for by the facts that the explosion occurred ¼ mile from the center of town and because most of the residents were attending a meeting.



March 28, Lewis, Ind. One of the rare cases of an explosion on a freight train load of explosives occurred after the derailment of a train in this community of 300. Seventy-five dwellings and mercantile buildings were damaged.

Thirty-three Other Big Fires in 1953

In addition to the large loss fires of 1953 that have been grouped and discussed in separate articles in this issue of the QUARTERLY there were thirty-three fires scattered among sixteen diverse occupancies, e. g., aircraft hangars, forests, oil wells, roundhouses. The total loss from these fires was $37,264,500. Individual reports are printed below but because of the relatively few fires in any one occupancy no attempt has been made to summarize experience by occupancy type.

Aircraft Hangar

Oct. 7, nr. Newburgh, N.Y. Stewart Air Force Base $620,000.

A midnight fire destroyed a 180 ft. by 120 ft. corrugated metal on wood frame hangar and one single engine aircraft. A C-45 transport parked on the hangar ramp was heavily damaged. Airmen succeeded in removing five other seriously exposed planes. During the day preceding the fire, welding and cutting work was done in the building by a contractor who was reinforcing wood roof trusses with steel members. Three small fires occurred on beams during this operation. Whether the origin of this fire was from a welding spark could not be positively established as detection was delayed until flames were visible three blocks away shooting through the roof.

Amusement Park

Nov. 14, Farmington, Utah Lagoon Co. $250,000.

Amusement park. Delayed discovery, congested combustible construction, inadequate water supplies and lack of familiarity with the property by seven responding fire companies were factors responsible for the destruction of a dance pavilion, cafe and beer parlor, game room, fun house, roller coaster shelter and several other buildings in the amusement park. The fire was discovered and reported by a neighbor when flames were high in the air. Underground fire service water supplies were limited to a dead-end four inch main from the Farmington distribution system. This supply was totally inadequate to stop the flame spread. Lack of familiarity with the property by responding mutual aid fire companies delayed use of water from a boat pond and a creek. The caretaker-watchman who lived on the property was asleep at 10:30 P.M. when the first alarm was received.

Arenas

Sept. 15, Oshawa, Ont. Oshawa Arena $375,000.

Arena for hockey and other sporting events. Fire originating in a players' room and discovered at 7:10 A.M. by an employee spread so rapidly through the combustible and undivided 36,400 sq. ft. interior of the brick, wood-joisted building that first arriving firemen were unable to fight the fire from inside. Flames quickly spread through wooden seats and partitions, and 30 minutes after discovery the roof and parts of the walls had collapsed. No watchman or automatic protection was provided.

Oct. 1, Albuquerque, N. M. Albuquerque Ice Arena $350,000.

Ice skating, wrestling, etc. Failure to provide automatic protection and watchman service were serious oversights in the fire protection for this 1-story masonry, wood-joisted building. Their absence was primarily responsible for its destruction since fire was beyond control when discovered by newsboys at 6:00 A.M. The fire originated in the not-cut-off furnace room and spread through the entire undivided 29,810 sq ft. building.

Bowling Alleys*

May 23, Elizabeth, N. J. Elizabeth Bowl, Inc., et al. $1,000,000.

Bowling alley, supermarket, offices, restaurant, bar. Responding to an outsider's alarm at 2:20 A.M., firemen found fire spreading rapidly through the undivided second story bowling alleys of the unsprinklered 30,000 sq. ft. 2-story brick, wood-joisted building. Thirty minutes later the roof fell in. Lightning is suspected as the cause of the blaze.

*See also Mar. 2 fire at Old Town, Me., page 305.

George Van

May 23, Elizabeth, N. J. A bowling alley and a supermarket, two occupancies often associated with excessive floor areas, occupied this 30,000 sq. ft. unsprinklered 2-story brick, wood-joisted building. The fire originated in the second story bowling alleys and was out of control when discovered by a passerby at 2:20 A.M.

Sept. 26, Lancaster, Pa. Arcade Building $250,000; 1 killed.

Bowling alley. A fire which originated in the pin refinishing room of a bowling alley was given tragic impetus by the explosion of a drum of thinner used in the process of pin refinishing. The wife of the manager was fatally burned trying to escape. Curtains which separated every two of the 24 alleys contributed to the spread of fire and their combustion was hastened because they were heavily laden with dust from sanding operations. Fire department operations were most effective in limiting the extent of damage principally to the third floor bowling alley occupancy. The vacant fourth floor section was undamaged and only slight water damage occurred on the first and second floors of the essentially fire-resistive building.

***Nov. 28, Lacombe, Alta. Memorial Recreation Center $250,000.**

Bowling alley, library, sports arena, auditorium. Two adjoining and communicating buildings built by volunteer labor during five years of construction bees were destroyed within 45 minutes by fire of undetermined origin. Construction plans had not included automatic fire protection. The fire was beyond control when discovered.

*Fire spread to other buildings.

Buildings Under Construction

Mar. 11, Newark, N. J. Anheuser-Busch, Inc. $700,000; 14 killed.

Beer fermentation building under construction. Fourteen men died, reportedly from smoke poisoning, and 31 were nonfatally poisoned or injured in fire that originated in cork insulation on the inner surface of one of two walls that formed a 3-ft. air space on all sides of the 6-story-high, fire-resistive building. Concrete beer tanks were being installed at five levels. A torch being used by workmen laying pipes within the air space was a possible cause. Fire spread up the continuous cork surface of the walls and involved wooden scaffolding. The victims were trapped in fermentation tanks at upper levels of the building when smoke was carried into the tanks by the ventilation system of the building that had no windows or roof openings.

April 18, Dallas, Texas Republic National Bank Building $500,000.

36-story office building under construction. Overturning of a 5-gallon can in which a fire had been built to warm employees on the 20th floor ignited plywood forms and caused fire that extensively damaged the 18th through 21st levels of the 36-story fire-resistive building under construction. The fire was first noticed by a

Denny Hayes

April 18, Dallas, Texas. The 18th through 21st levels of this 36-story fire-resistive office building under construction were severely damaged by fire that originated when a 5-gallon can containing a fire to warm employees on the 20th level tipped over and ignited construction materials. Hose had to be hauled up to the fire with ropes because standpipes had not been installed as construction progressed.

passerby at 5:32 P.M., about an hour after construction crews left the building, Since standpipes had not been installed as construction progressed and since the materials hoist cable was destroyed early in the fire, it was necessary to haul hose by rope to the fire area before water could be discharged. The fire department did commendable work in controlling the fire and in extinguishing the large number of fires started on exposures by wind-carried embers.

City and Country Clubs

***Feb. 1, Monmouth, Ill. Elks Club, et al. $252,500.†**

Lodge hall, clothing and dry goods store, billiard parlor; bank. Old, improperly installed and overloaded electric wiring was the probable cause of fire that originated in the attic of the unsprinklered 3-story brick, wood-joisted building. Smoke and flames were coming from the roof when the fire was discovered by an outsider at 4:49 A.M. The attic and roof were totally involved when apparatus arrived and fire was extending to lower floors through unprotected openings. Local and mutual aid companies concentrated on saving exposures. With the help of unpierced fire walls they were for the most part successful but slight damage was done to the wood roof of an otherwise fire-resistive 2-story bank building.

April 21, Waterford, Mich. Pontiac Country Club $250,000.

Golf club. Fire had made considerable headway in the 1- and 2-story building before 2:45 A.M. when the only occupant, asleep in the second story, awakened and jumped to the ground to save his life. A stiff breeze whipped the flames through the large combustible structure. Origin appeared to be in the kitchen.

***Nov. 8, Conneaut, Ohio Moose Club, et al. $350,000.**

Club rooms, restaurant; four apartments, drug store. At 10:00 P.M., after most of the guests had departed from a club supper, members discovered that fire was burning above the ceiling of second story club rooms. Fire spread within nonfirestopped walls and above ceilings to all parts of the 10,000 sq. ft. 3-story brick, wood-joisted building, broke through the roof, and entered a 3-story exposure through plain glass skylights

*Fire spread to other structures.
†Includes business interruption loss.

in the roof. Had an aerial ladder been available from which a hose stream could be directed on the roof of the exposure, the fire, in the opinion of the fire chief, could have been confined to the building of origin.

Dec. 18, Homestead, Pa. Elks Club of Homestead $300,000.

Club rooms. The 3-story brick, wood-joisted building (ground floor area 4,400 sq. ft.) was destroyed by fire that originated in the motor room in the basement. On discovering smoke at 8:15 A.M. the janitor spent several minutes trying to trace it to its source before going to the fire department to report the fire. In the meantime fire entered a nonfirestopped wall space where it broke a gas pipe. A frozen curb valve delayed shut-off of the gas for 1½ hours. During this time flames spread within nonfirestopped walls and ceilings to all stories and through the roof.

Forest Fires

April 17, Circle Cross, N. M. U. S. Government, Lincoln National Forest $400,000.

25,874 acres. Fire originating in what was considered an inadequate and unsafe disposal pit on private land spread into adjacent forest land, destroying 25,874 acres of mixed timber, mostly pine, before being controlled.

July 10, Big Dalton, Calif. U. S. Government, Los Padres National Forest $550,000.

74,165 acres. An arcing power line was the reported cause of fire that burned over 74,165 acres of watershed and range land. Cost to control the fire was $250,000.

Aug. 7, nr. Forestville, Que. Anglo Canadian Pulp and Paper Co., et. al. $1,000,000.

175 sq. miles. Approximately 175 sq. miles of spruce and balsam forest were burned by fire believed caused by berry pickers 48 miles north of Forestville.

Aug. 17, St. Therese de Colombier, Que. Anglo Canadian Pulp and Paper Co., et al. $300,000.

Area unknown. Pulpwood, cut and stacked beside roads and elsewhere awaiting collection, was destroyed in a forest fire that burned over an unknown acreage.

Aug. 26, Arrowhead Springs, Calif. U. S. Government, San Bernardino National Forest $2,337,000.

3,640 acres. Children playing with firecrackers started this fire that destroyed 3,640 acres of watershed cover. Cost to control was $110,000.

Sept. 9, Fish Fork, Calif. U. S. Government, Angeles National Forest $7,550,000.

24,000 acres. Lightning caused fire that destroyed 24,000 acres of watershed cover. Cost to control the fire was $550,000.

Dec. 27, Los Angeles County, Calif. U. S. Government, Angeles National Forest $2,069,000.

8,980 acres. Careless smoking was the reported cause of fire that burned 8,980 acres on Mt. Baldy.

Associated Press Wirephoto

Dec. 27, Los Angeles County, Calif. One of the worst forest fires of 1953 was the one pictured here, which burned 15,000 acres of watershed, brush and pine forest.

Dec. 27, Los Angeles County, Calif. U. S. Government, Angeles National Forest $6,900,000.

15,000 acres. Approximately 15,000 acres of watershed, brush and pine forest of the Angeles Forest, called by some experts the world's most valuable watershed because of the heavy population and valuable land in the Los Angeles area beneath it, were burned over by gale-driven flames. Careless smoking was the reported cause. Fire fighting expense was more than $250,000.

Laundry

Mar. 31, Oakland, Calif. California Linen Supply Co. $283,000.

Laundry for hotel linen and towel service. The 12,600 sq. ft. 2-story brick section and much of the communicating 1-story wood-frame, metalclad section were destroyed by

April 19, Grand Prairie, Texas. Paintings and other art works valued at approximately $1,000,000 were destroyed when fire swept this unsprinklered 2-story combustible building. A sprinkler system that formerly protected the building had not been maintained in operation.

fire discovered by outsiders at 3:20 A.M. No automatic protection or watchman service was provided, but an employee lived in the metalclad section. The latter said he went through the plant at 11:00 P.M. before going to bed and noticed nothing wrong. The fire had been reported before he became aware of it. Fire had control of the brick section when apparatus arrived and spread through half of the metalclad section before being controlled. An electrical fault in one of the many pieces of equipment was believed to have caused the fire. Investigation revealed that contrary to the management's orders, 18 of the 21 electric switches in the building had been left on at the close of work.

Mess Hall

July 14, Brunswick, Me. U. S. Government, Department of the Navy $427,000.

Mess hall, library, lounge, pool hall, barracks. Substandard watchman protection that did not require that the watchman on his half-hourly tours go through the pool room delayed detection of fire until it could not be controlled by extinguishers and standpipe lines used by occupants. By the time professional fire fighters were on the scene flames were spreading throughout the 271 ft. by 119 ft. unsprinklered 1-story wooden building. The only partitions in the building were eight feet high and were constructed of combustible fibreboard.

Museum

April 19, Grand Prairie, Texas The Bagdad $1,150,000.

Private art museum. Valuable paintings, tapestries and other works of art were destroyed by fire that severely damaged the recently renovated 2-story combustible building. Fire originated in the owner's first story sleeping quarters and was caused by ignition of bedding and a rug by an electric heater. Had the sprinkler system been in operation the fire could undoubtedly have been controlled before spreading through unprotected horizontal and vertical openings. The elevated storage tank supplying the system had been abandoned and connection to city mains 200 ft. away had not been made because the cost was considered excessive.

Office Building

***May 2, nr. Phoenix, Ariz. Tovrea Land and Cattle Co., et al. $267,500.†**

Offices, restaurant. Eight 1- and 2-story masonry and wooden buildings, which because of unprotected openings in fire walls

*Fire spread to other structures.
†Includes business interruption loss.

May 2, nr. Phoenix, Ariz. Nonstandard hydrant threads and defective hydrants on a private water system complicated efforts of fire fighters to save part of a 250-ft.-long combustible office building. The wheel broke when firemen attempted to open the defective valve at left.

comprised a single fire area 250 ft. long, were destroyed or badly damaged by fire believed caused by a defective range flue in the kitchen of the 1-story restaurant. When discovered the fire appeared to be above the kitchen ceiling in the vicinity of the range flue and was coming through the roof over the kitchen. Fire department response was delayed due to an incorrectly telephoned alarm, and when fire fighters arrived and took a 1½-inch standpipe hose to the roof, flames were spreading through ventilating ducts, above false ceilings and through unprotected openings in fire walls to adjoining buildings. Several additional fire departments responded. They saved one large communicating building although considerable difficulty in getting water from the private water system was experienced due to non-standard threads on hydrants and a defective hydrant.

Oil Wells

Jan. 25, Gulf of Mexico Pure Oil Co. $1,000,000.

Oil well drilling rig, barge, platform, machinery. Rupture of a flow line at an underwater oil well's "Christmas tree" was followed by explosive ignition of gas. On the following day a nearby second well had also ignited. The fires burned until February 6 when they were extinguished by oil well fire fighting experts.

Mar. 5, nr. Vernal, Utah Kerr-McGee Drilling Co. $250,000.

Oil well drilling rig. While drilling below the 10,000 ft. level the drill struck a natural gas pocket, resulting in escape of gas from the well. When an attempt was made to shut off the gas by closing the electrically operated blowout preventers, a spark from an electric motor ignited the gas. Within 20 minutes the 120-ft-high steel derrick had collapsed. The fire was brought under control five hours later by flooding the well.

Glen Perrins

Mar. 5, Vernal, Utah. Oil well fires generate intense heat that usually causes total destruction of drilling equipment.

Dec. 16, Gulf of Mexico Gulf Refining Co. $314,500.

Oil well drilling rig, barge, derrick. Blowout of this off-shore oil well (near East Timbalier Island, a part of Lafourche Parish, La.) resulted in fire that was allowed to burn for two days because of certain safety precautions. When the fire was finally brought under control, at a cost of $55,000, the barge, rig, derrick and engine had been destroyed.

Pier

Oct. 4, Vallejo, Calif. U. S. Government, Dept. of the Navy $500,000; 1 killed.

700-ft-long L-shaped pier; 3 pier sheds; 2 barges. Fire of undetermined cause originating beneath the deck of the undivided pier consumed the wooden pier and three wooden pier sheds, and damaged two barges tied to the pier. Heat was so intense that fire boats had difficulty getting close enough to reach the fire with hose streams. One fireman fell off a fire boat and drowned, and ten were injured. No sprinkler protection was provided for the substructure or pier sheds.

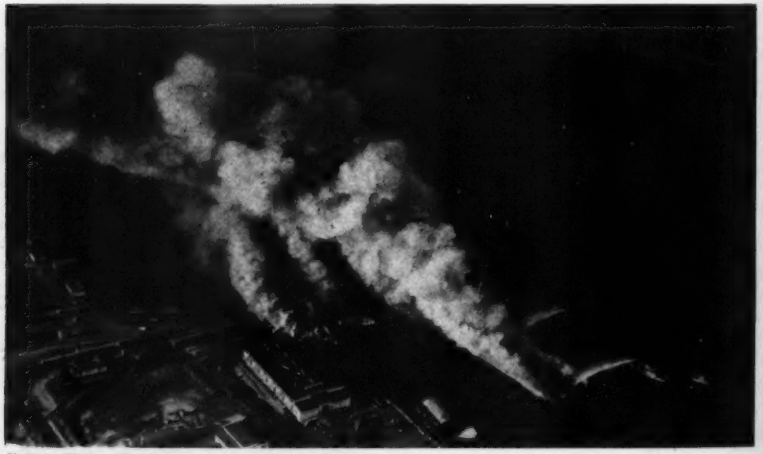
Railroad Roundhouses

Sept. 2, Huntington, Ore. Union Pacific Railroad Co. $250,000.

Roundhouse and repair shop. The 16-stall brick, wood-joisted roundhouse was destroyed and five steam locomotives were extensively damaged by fire that originated in stall No. 1 which had been converted into the water service section. Cause was not determined. Flames spread rapidly feeding on grease and oil as crewmen hastened to put private hose streams in operation and remove engines. Four of the eleven locomotives were removed before wiring burned out and power to operate the turntable was thereby lost. Power to the electric fire pump boosting pressure in yard mains was also lost but the steam pump was immediately placed in operation. Adequate pressure was maintained until the 6-inch main, which on entering the roundhouse was suspended from roof beams, was ruptured by collapse of the fire-weakened roof. Up to this point it appeared that the fire could be kept within the 12-stall area on one side of a brick wall that separated the building. However, with loss of water the fire brigade could not keep the flames from spreading over the wall. The public fire department, aided by departments responding from as far as 45 miles away, was concerned primarily with cooling down exposures and putting out spot fires caused by wind-carried sparks that showered the business and residential area of the town.

Nov. 12, nr. Hodge, La. No. Louisiana and Gulf Rwy. Co., et al. $1,000,000.

Railroad roundhouse, three diesel locomotives. Fire of undetermined origin involving a large quantity of diesel fuel in a roundhouse was indirectly responsible for a freight train wreck. In an effort to rescue a flaming diesel engine from the roundhouse an employee lost control of the engine. The unmanned engine went at high speed for five miles, then hit an oncoming freight train. The two diesel engines on the freight and the runaway engine were badly damaged or destroyed. The crew of the freight anticipated the accident in time to jump.



Vallejo Times Herald

Oct. 4, Vallejo, Calif. Fire originating in the substructure of this undivided and unsprinklered 700-ft.-long pier destroyed the pier and three pier sheds.

Sewer

Cleveland Fire Department

Sept. 10, Cleveland, Ohio. One person was killed, 64 were injured and damage estimated at $5,000,000 resulted when an explosion demolished 1.2 miles of a combination storm and sanitary sewer.

Sept. 10, Cleveland, Ohio City of Cleveland, et al. $5,000,000; 1 killed.

Sewer. A violent explosion at 5:20 P.M. in a combination storm and sanitary sewer demolished 1.2 miles of the sewer. One woman was killed, 64 persons were injured, automobiles were crushed, and water and gas mains were broken as reinforced concrete road paving above the sewer was upheaved. The only ensuing fire was caused by a short circuit of wiring in an automobile hit by debris. (See October, 1953 *Quarterly*.)

Vacant Building

***Sept. 22, Providence, R. I. Podrat Bros., et al. $269,000.**

Vacant bldg., multiple occupancy bldg., paper whse., pipe whse. Fire officially listed as of undetermined cause (two boys who had admitted in separate stories that they entered and set fire to the building were released by the Juvenile Court) destroyed a sprinklered 5-story brick, wood-joisted building of origin and caused slight to moderate damage to three exposed sprinklered buildings. Sprinklers in the building of origin had been shut off since Sept. 1 because of alterations to the building and consequently the fire had opportunity to spread beyond control through numerous unprotected openings before fire apparatus responded at 2:30 A.M. to a passing motorist's alarm. The building was completely destroyed and heat ignited a wood-frame, asbestos shingled outside elevator tower on a sprinklered 5-story building 30 ft. away. Fire also spread through the top story (wood-frame, slateclad mansard roof) and burned out all windows on the exposed side. Sprinklers on the lower four floors kept the fire from entering, but in the fifth story, where all sprinklers operated, the intense fire spread through the open joist construction. Sprinklers were overpowered due to small pipe sizes (installed prior to 1896) and because sprinklers were unstaggered beneath open joists.

Paint was blistered on window casings and on inside partitions for a distance of four feet from the exposed wall on a sprinklered 4-story building across a 63-ft.-wide street. Heat was not sufficient to operate sprinklers in this building. A 6-story paper warehouse adjoining the building of origin was protected against exposure by a blank fire wall and wired glass in metal frames in windows at an angle to the building of origin. Heat radiated through a wired glass window in the third story and started a fire that was extinguished by one sprinkler.

Providence Journal-Bulletin

Sept. 22, Providence, R. I. Sprinkler protection, that would undoubtedly have kept damage from this fire to an insignificant amount, had been shut off for 22 days because of alterations.

*Fire spread to other structures.

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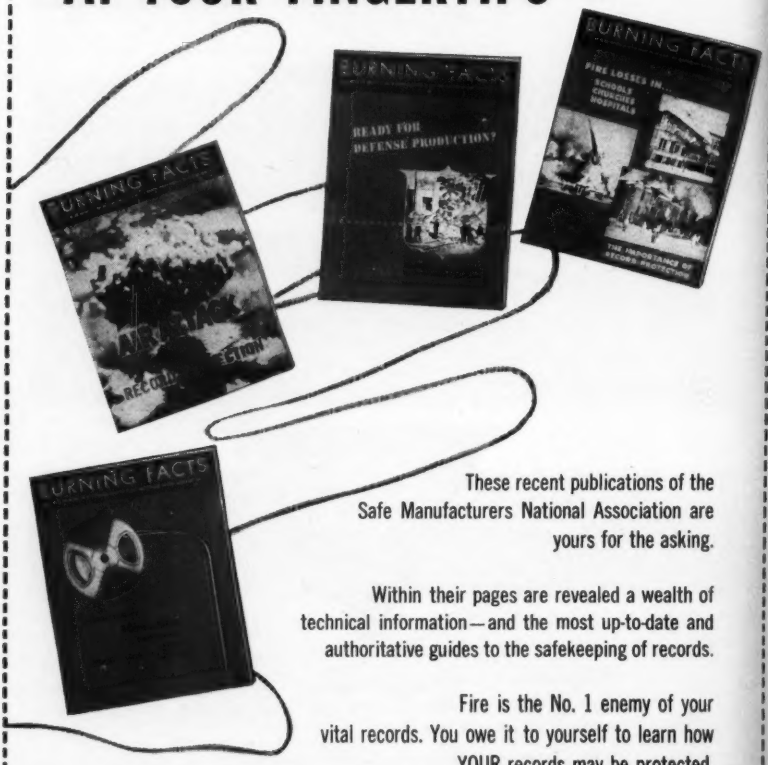

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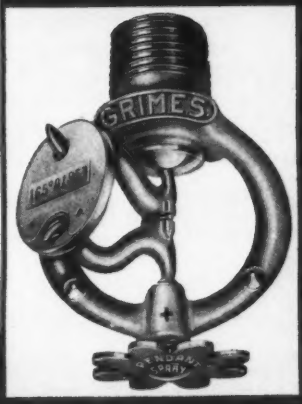

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6 Facts About Van-Packer Chimneys

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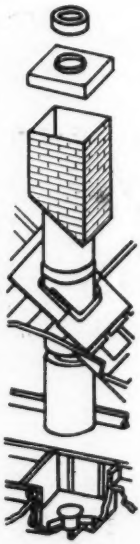

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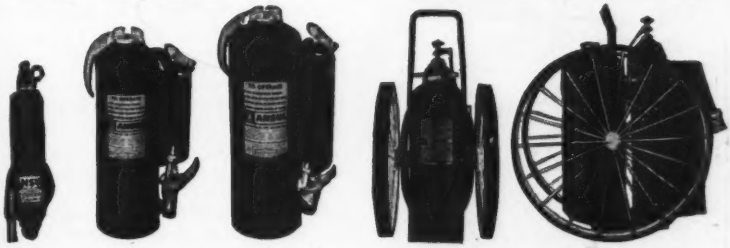

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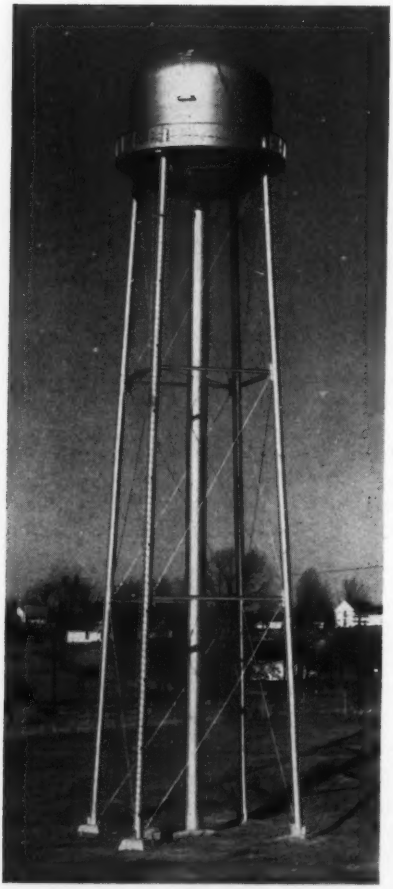

The Horton elevated tank at the left provides gravity water pressure for fire protection at a textile mill in Liberty, S. C. It holds 50,000 gals. and is 100 ft. to bottom.

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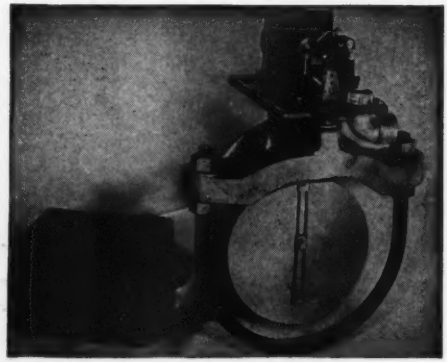

5-inch size shown above. To install simply drill 2-inch hole in pipe.

Model PRS-1 Sprinkler Waterflow Alarm

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- This device is also made as Model PRT-1, a coded waterflow transmitter.

- Also made in explosion proof models.
- Made in all sizes from 2½" to 8".
- Has instantly recycling pneumatic retarding device, which prevents false alarms.
- Has enclosed electrical contacts for 15 amp. 125 volts, A.C. and ½ AMP. 125 volts, D.C.

Size is 1⅝" x ⅝"

Tempo-Set Model A Fire Detector

Underwriters' Laboratories, Inc. Approved.

- Self restoring and can be heat tested.
- Electrical contacts are silver or gold and are enclosed.
- Very reasonable price.

- Tempo-set Model A is approved in either open or closed circuit and the temperature ratings are 140 and 200 degrees.
- Approved spacing is 20′ x 20′.
- Electric ratings are 125 volts 1 ampere, A.C. or 24 volts 0.5 ampere D.C.

CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station Systems or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

53 WEST 23rd STREET **NEW YORK 10, N. Y.**

Handclasp of a friend-in-need

There's confidence in the very "feel" of the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers. The quick-acting "Squeez-Grip" fits your hand naturally like a handclasp . . . hangs right . . . carries right . . . works right. You're in complete command of the situation instantly . . . no fumbling . . . no fatigue.

From the non-conducting, shatterproof discharge horn through to the high strength, durably finished cylinder, you get top quality construction that results in a lifetime of satisfactory service. Because of the very few working parts and corrosion resistant materials throughout, the total cost to you over the years is less than other initially lower priced makes . . . fire after fire, recharge after recharge, without trouble.

It's not hard to see, when you fully compare and try, why C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers are your best buy for killing flammable liquid and electrical fires, as well as some surface fires involving ordinary combustible materials. Sizes range all the way from 2½ to 100 pounds capacity . . . all fully approved by the Underwriters' Laboratories, Inc., Factory Mutual Laboratories, Armed Forces and Government Bureaus.

With C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers the penetrating carbon dioxide is a clean, dry, non-damaging, non-conducting, inert gas . . . smothers fire instantly, leaves no after fire mess . . . harmless to equipment, materials and finishes . . . even food is still perfectly edible.

Act now for complete free information on these first-rate, sure-acting fire extinguishers. Remember fire doesn't wait . . . get the facts today!

C-O-TWO

MANUFACTURERS OF
APPROVED FIRE PROTECTION EQUIPMENT
Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY

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Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

DETECT-A-FIRE®

Rate Compensation Actuated THERMOSTATS insure positive Fire Detection for alarm or release systems

Fenwal DETECT-A-FIRE units are based on an entirely new principle. The outer shell is the sensing element — reacting to the temperature of the air around it. The contacts function when surrounding air reaches a danger level.

- *Hermetic Sealing* of internal electrical components.
- *Stainless Steel Construction* — for corrosion resistance and long life.
- *Temperature Setting Range*, 140 F to 725 F.
- *Long Spacing* . . . 25 feet . . . economy of installation.
- *Repeatable.* Unit re-sets itself, nothing to replace.
- *Shock and Vibration Resistant* . . . rugged construction.

SERIES 70 HORIZONTAL MODEL

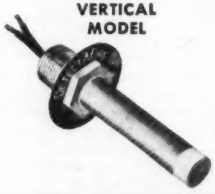
For locations where appearance is a factor. Suitable for all commercial, industrial, mercantile and public buildings, institutions and ships, in locations classified as "ordinary" under the National Electric Code.

TYPES 7020 and 7021

Flush Mounting Unit for new construction and concealed wiring. Type 7020, normally closed circuits; Type 7021, normally open circuits. Designed to fit standard 4" junction boxes. For exposed wiring, Types 7020-1 and 7021-1 with surface adapter ring.

LISTING and APPROVALS: Ⓤ, ⟨FM⟩, USCG, and American Bureau of Shipping Acceptance.

SERIES 71 VERTICAL MODEL



For ordinary and hazardous locations i.e., Class I, Groups C and D; Class II, Groups E, F, and G. Explosion-proof in itself. For hazardous locations, mount to Crouse Hinds CPS 021 Cover or Appleton BFGS Hub Cover for explosion-proof system.

TYPES 7120 and 7121

For concealed and exposed wiring. Type 7120, normally closed circuits. Type 7121, normally open circuits.

LISTING and APPROVALS: Ⓤ, ⟨FM⟩, and American Bureau of Shipping Acceptance.

SEND FOR THESE BULLETINS.

They give the latest authoritative data on fire or overheat detection. They discuss in full the rate compensation principle; give exact engineering data. Write for Bulletins MC-107A and MC-108 to Fenwal Incorporated, 1410 Pleasant Street, Ashland, Mass.

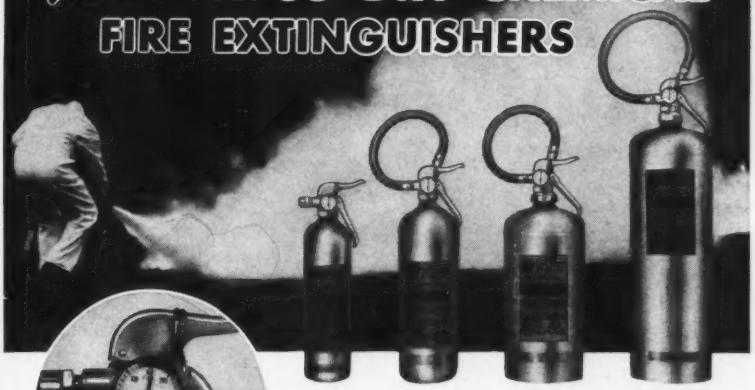
Fenwal

DETECT-A-FIRE® Thermostats

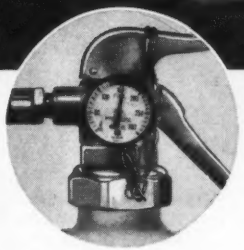
DYNAMIC, RATE COMPENSATION ACTUATED FIRE DETECTORS

New ALFCO DRY CHEMICAL FIRE EXTINGUISHERS

THEY'RE PRESSURIZED - READY TO GO!



PDC-5 PDC-10 PDC-20 PDC-30



A glance at valve gauge indicates whether unit is in operating order.

Unmatched in Fire Smothering Efficiency!

WHEN FIRE HITS, THESE NEW ALFCO DRY CHEMICAL MODELS ARE READY TO STOP IT

With Valve and Siphon Assembly removed as single unit, ample size opening is provided for charging.

Simply pull pin and squeeze lever. No gadgets to operate, no last minute pressurizing from a gas cartridge or cylinder, no inverting, no bumping, no shut-off nozzle on the hose needed. They're ready to go!

Their fire-smothering efficiency is aided by a scientifically designed Alfco Discharge Nozzle which fans the Dry Chemical outward and downward in wide pattern and with great density. Their 150 (plus 25 minus 0) psi. air (or nitrogen) pressure maintains an excellently uniform duration of the Alfco Dry Chemical discharge pattern.

When partially operated, they can be left standing without loss of air pressure.

The Alfco Dry Chemical Valve is completely new also. It is ruggedly built. No special tools needed. Contains few parts. Equipped with Safety Relief Valve. Complete valve and siphon tube assembly removes as a single unit for recharging. They're water-tight, and noncorrosive. Tested for vibration and for operation at temperatures from minus 40° F. to plus 150° F. An Alfco Moisture Trap provides for pressurizing with air.

Write us for illustrated literature and full details of their special features.

Model numbers designate the capacities by weight of Dry Chemical.
Approved by Underwriters' Laboratories for Class B and C Fires.

OUR 2nd Century of Leadership in FIRE PROTECTION

AMERICAN-LAFRANCE-FOAMITE Corporation

ELMIRA NEW YORK U.S.A.

IN CANADA: LAFRANCE FIRE ENGINE & FOAMITE LTD., TORONTO

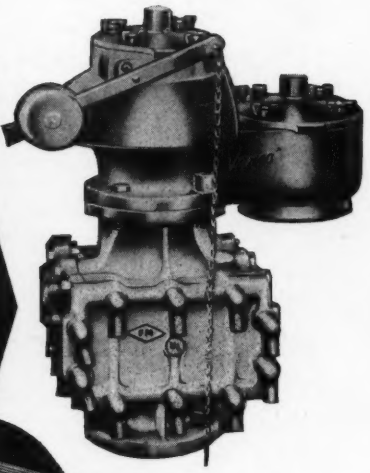
ALFCO

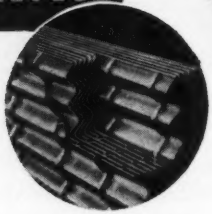
WHEN STORING FLAMMABLE LIQUIDS IT PAYS TO BE

EXTRA Safe

with "Varec" FLAME ARRESTERS

In combination with your VENT VALVES





"VAREC" Fig. No. 5800 Vent Unit consisting of "VAREC" Conservation Vent Valve in combination with "VAREC" Flame Arrester.

The belief that conservation vents or breather valves alone will prevent travel of flame back into flammable liquid storage tanks is questionable because of the many contributing factors. Careful authoritative analysis reveals that valves by themselves do provide *some protection* but this "protection" *is by no means adequate* under all circumstances.

Safety authorities emphatically advise that "vent valves are not regarded as providing the required protection against fire and explosion." A textbook on safety states that "a conservative policy is to provide flame arresters in conjunction with other vent equipment on all cone-roof atmospheric tanks handling oils with a flash point up to 200°F open cup."

"VAREC" Flame Arresters when used as a unit with "VAREC" Vent Valves give you full fire protection at extremely low cost. Average installations run approximately .1 of 1% of your investment in tank and products. Consult your nearest "VAREC" representative or write for further information.

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, U. S. A.

Cable Address: VAREC COMPTON USA (All Codes)

NF-1

PROVED and APPROVED "Varec"

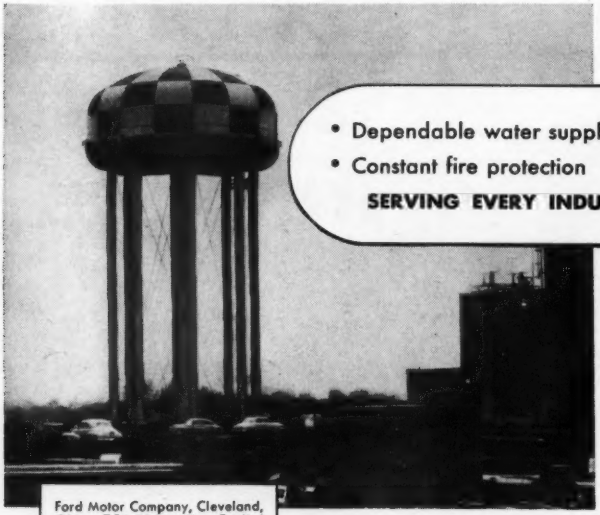
RELIABLE SPRAY SPRINKLER

- Greater Coverage!
- Lower Ceiling Temperatures!
- Faster Cooling of Hot Fire Gasses!
- Better Fire Extinguishment with Less Water!
- Fewer Sprinklers Operating Adjacent to Fire Area!

Incorporating the new principle of water distribution, the Model "C" Spray Sprinkler is another example of Reliable's leadership in new product design. All Reliable Sprinkler Devices are the assurance of the ultimate in fire protection . . . and have been protecting life and property for over 30 years! Reliable Sprinkler Devices are distributed . . . installed and serviced by Reliable's chain of licensed representatives located throughout the United States, Canada and foreign countries. A Reliable representative is as near as your phone. . . . Call him for a system designed to your specific needs!

Constant Fire Protection That's Always "Reliable"!

THE RELIABLE AUTOMATIC SPRINKLER CO. INC.



- Dependable water supply
- Constant fire protection

SERVING EVERY INDUSTRIAL NEED

Ford Motor Company, Cleveland, Ohio. 750,000-gallon Radial Cone Bottom Tank. Diameter 73'; head range 25'; height to bottom 100'.

Ford Motor Company, Hamburg, New York. 250,000-gallon Double Ellipsoidal Tank. Diameter 38'; head range 33'; height to bottom 123'.

PITTSBURGH-DES MOINES

Elevated Steel Tanks

These recently-erected tanks, serving the water storage requirements of two new Ford Motor Company plants, typify the hundreds of industrial PDM Elevated Steel Tank installations for companies of every size from coast to coast. Let us consult with you on the type and capacity of tank best meeting the demands of economy, efficiency and safety for your plant.

PITTSBURGH · DES MOINES STEEL CO.

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Sales Offices at:

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NEWARK (2) . . . 250 Industrial Office Bldg.
CHICAGO (3) . 1272 First National Bank Bldg.
DES MOINES (8) . . . . 969 Tuttle Street
DALLAS (1) . . . 1273 Praetorian Building
SEATTLE . . . . . 576 Lane Street
SANTA CLARA, CAL. . 675 Alviso Road

Once it gets a foothold, fire rips into a plant like a monstrous claw. That means every hazard . . . flammable liquids, electrical equipment as well as ordinary combustibles . . . should be guarded with Kidde Portable Extinguishers or Built-in Systems.

Walter Kidde & Company, Inc.
151 Main St., Belleville 9, N. J.
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VIKING spray sprinklers

efficient

adaptable

economical

Here's the head the entire fire underwriting and protection "industry" is talking about. The Viking Spray Sprinkler incorporates an entirely new principle in sprinkler protection. Water in spray form emanates from the head at a 180° angle . . . prevents ceiling ignition . . . prevents hot gases from opening heads out of flame range. Your nearest Viking representative will give you all the details.

the VIKING corporation

HASTINGS, MICHIGAN

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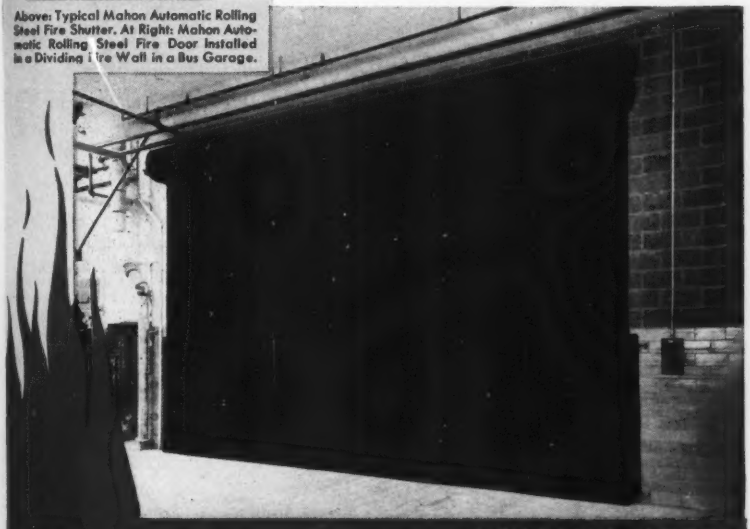
Automatic Rolling Steel
FIRE DOORS *and* WINDOW SHUTTERS
PREVENT SPREAD *of* FIRE!

You need good automatic fire doors in fire walls, corridors, and vertical shafts . . . in some cases automatic rolling steel window shutters are necessary to protect your building and its contents from fires which may originate in nearby buildings. Many, many cases are on file which confirm that timely action of automatic rolling steel fire doors and window shutters have confined a fire to its point of origin and permitted its being extinguished with comparatively small damage. Make a survey of your building now, and don't delay action. You will find a Mahon Automatic Rolling Steel Fire Door or Window Shutter to meet each of your requirements—all bear the Underwriters' Label. These automatic fire doors may be operated manually or mechanically in every day use. If a fire should break out while they are in the open position, the automatic mechanism will close the door, cutting off drafts and preventing the spread of the fire. See Sweet's Files for complete information, or write for Catalog 654.

THE R. C. MAHON COMPANY
Detroit 34, Michigan • Chicago 4, Illinois

Manufacturers of Automatic Rolling Steel Fire Doors and Window Shutters. Also Many Types of Standard General Service Rolling Steel Doors and Grilles, Insulated Metal Walls, and Steel Deck for Roofs, Floors and Partitions.

Above: Typical Mahon Automatic Rolling Steel Fire Shutter. At Right: Mahon Automatic Rolling Steel Fire Door Installed in a Dividing Fire Wall in a Bus Garage.



MAHON ROLLING STEEL FIRE DOORS and WINDOW SHUTTERS

Use ROLAGRIP couplings for fast, low cost sprinkler installation

This is a 6″ ROLAGRIP coupling for plain end pipe on a sprinkler bulk line in a midwestern aircraft plant. ROLAGRIP couplings and plain end steel pipe were used here because the contractor had to install a permanent, low cost sprinkler system *in a hurry.*

Because the sprinkler system was coupled with ROLAGRIPS, pipe came straight from the mill in economical mill run lots . . . ready to install. It required no special machining, handling or shipping preparation. The pipe was not weakened by threading, beveling or grooving.

Installation time and labor were cut because ROLAGRIPS go on in three steps: (1) grease the special synthetic rubber gasket (to prevent pinching) and center it over the pipe ends; (2) lay twin ROLAGRIP housing halves over gasket; and (3) insert and tighten two bolts.

Chances are, ROLAGRIPS will save you time and money, too. They come in 1½″ to 12″ sizes; are approved by Factory Mutual and Underwriters' Laboratories.

See ROLAGRIPS at your supply store this week. (For grooved pipe, ask for GRUVAGRIPS and GRUVAGRIP FITTINGS — sizes ¾″ to 14″.) Or write today for prices and free illustrated folder #NCF.

GUSTIN-BACON MANUFACTURING COMPANY

210 West Tenth Street **Kansas City 6, Missouri**

SAFER

liquid handling for Industry

THIS NEW TOKHEIM HAND PUMP contributes to safer handling of volatile liquids wherever used. Stops wasteful dripping and slippery floors. Reduces fire hazard and accidents common to other methods of liquid transfer. Approved for handling petroleum liquids—ideal for many others. Available in hose and spout models—for drums, skid tanks and underground installations. Order from your dealer, your oil company or your Tokheim representative. **Write factory for literature.**

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Designers and Builders of Superior Equipment Since 1901
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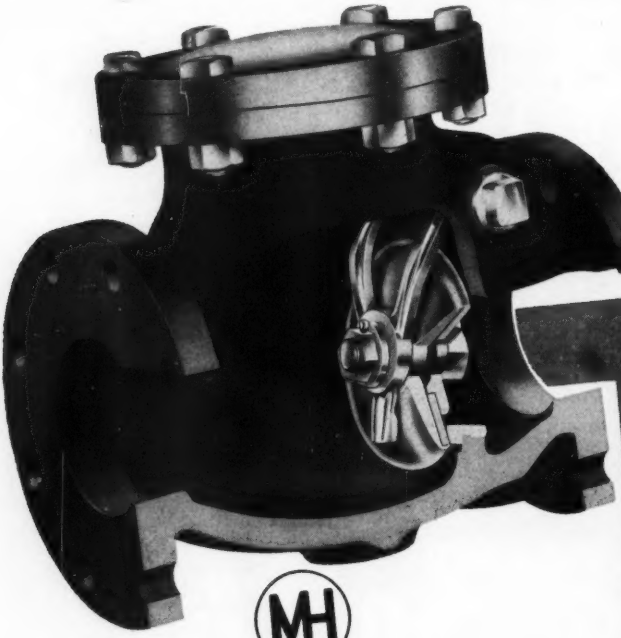

MH

CHECK VALVES

Cutaway view above shows how disc is mounted on clapper arm. Disc facing is bronze or rubber. Seats are bronze. Hinge pin is stainless steel. M & H Check Valves may be installed in horizontal or vertical position. Disc swings entirely clear of waterway and will not stick in open position. Two bosses on each side may be tapped for bypasses and two bosses on bottom may be tapped for draining.

Furnished with flanged, screwed, hub, mechanical joint or Universal end connections. Flanged check valves can be furnished with outside lever and weight or outside lever and spring. Both the weight or the spring are adjustable for positive and easy opening and closing, and to minimize slamming and banging of the disc.

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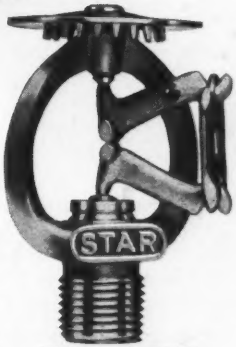
M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

The AMAZING New

Star Spray Sprinkler!



(MODEL C—UPRIGHT)

With its

Unequalled Performance

Gives You . . . . . .

SUPERIOR PROTECTION — revolutionary in method — for any type of occupancy — no matter how severe the hazard . . . . . with **LESS WATER USED** — more effectively and more efficiently — for total extinguishment and cooling. . . . All water discharged goes directly on the fire — not on the ceiling. . . . Ceilings are so cooled that no sprinkler will open unnecessarily. . . . . .

STAR SPRAY SPRINKLERS — the ultimate in modern fire protection — can replace former-type sprinklers without changes in piping. . . . . Available for installation in either **UPRIGHT** or **PENDENT** position.

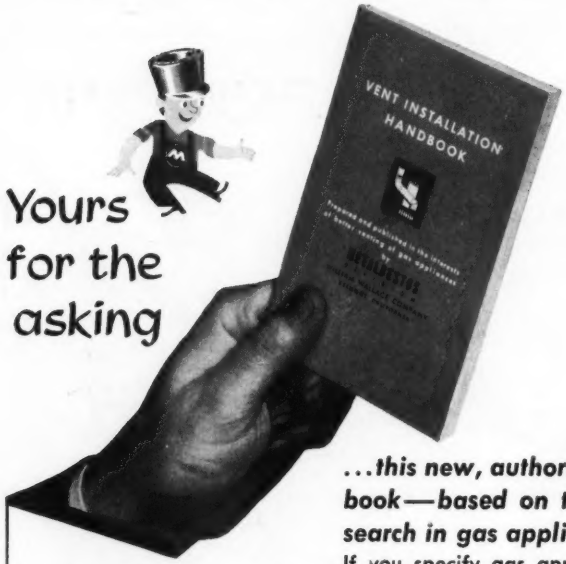
Approved by Factory Mutual Laboratories
Listed by Underwriters' Laboratories, Inc.

Write for name and address of STAR licensed contractor nearest your location, to:

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. — Philadelphia 34, Pa.

Licensees in all Principal Cities of the United States and Canada



Yours for the asking

...this new, authoritative handbook—based on the latest research in gas appliance venting

If you specify gas appliance installations, you'll want this handbook containing complete information on the installation of gas venting systems. The findings presented are based on extensive engineering research recently completed by the Metalbestos Division, William Wallace Company, with the assistance of Stanford Research Institute.

Here are some of the subjects covered:

- *Fundamental Rules of Venting*
- *Determining Correct Vent Sizes and Capacities*
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- *Vent Installation Tips*

Amply illustrated throughout—and indexed for convenient reference—this handy pocket-size booklet will be an invaluable aid to anyone who specifies, sells, installs or services gas burning installations.

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Please send me, without cost, _____ *copies of the* **VENT INSTALLATION HANDBOOK.**

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CITY ZONE STATE

Rockwood Announces

NEW WaterFOG SPRINKLER HEADS

Now! Conventional sprinkler systems get benefit of powerful fire-fighting WaterFOG

A result of years of research!

New Rockwood TU-57 and TP-57 Heads put fire-destroying WaterFOG to work for *you*. Consists of millions of tiny water particles that control and conquer fires *immediately*.

The new Heads direct the WaterFOG *away* from ceiling, right down into the flame area. All the WaterFOG is used on the fire — none is wasted overhead. Gas and flames are prevented from mushrooming and needlessly opening adjacent heads. What's more, the high level uniformity of the WaterFOG pattern acts as a wall of cooling water particles blocking gas and flames from ceiling.

Due to their unusual efficiency, *fewer* heads are required in a given area; use less water and result in less material damaged by fire, less damaged by water, less production time lost. Hazards formerly in extra hazard classification can be considered ordinary hazards when the new WaterFOG Heads are used. High piled materials, with their dangerous burning stack effect, get full protection from the new Heads as do rubber tires, foam rubber, excelsior and other rapid-burning materials that liberate great quantities of heat. Insurance authorities permit up to 30% increase in allowable area covered by one head and up to 50% increase in allowable distance between heads.

Write for complete details.

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ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses

56 Harlow St., Worcester 5, Mass.

BLOCK THE SPREAD OF FLAMES AT ALL OPENINGS

CUT OFF DRAFTS

DEFY FLAMES

Made ONLY by KINNEAR

Akbar ROLLING FIRE DOORS

Kinnear all-steel Akbar Fire Doors are the positive, automatic means of blocking off flame-spreading drafts.

Coiled out of the way over the door lintel, Akbar Fire Doors go into action immediately when fire threatens. A strong spring insures positive action. Controlled speed provides added safety of building occupants. Akbar Doors may be opened instantly for emergency exit. They automatically close again at once. A special locking device stops the downward action of Akbar Doors at sill level . . . even if the floor is completely burned out. Akbar Rolling Fire Doors can save as much as one third their cost per year in reduced insurance rates.

Akbar Fire Doors may be equipped for daily use with manual or motor operation.

LARGE SIZES:** Kinnear makes doors for firewall openings ranging up to many hundred square feet in area. These doors are built with the same features offered in the labeled doors described above. **WRITE FOR DETAILS!

The KINNEAR Manufacturing Co.

FACTORIES:

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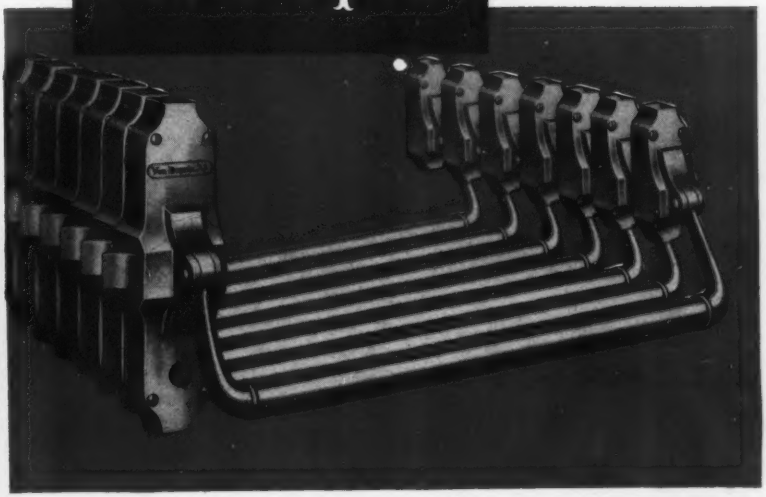
SAVING WAYS for DOORWAYS

KINNEAR ROLLING DOORS

Von Duprin



Builders of Fire and Panic Exit Devices Since 1908

● Back in 1908, Von Duprin built the very first panic device. Ever since that time, Von Duprin has been the leader in this highly specialized field . . . the leader in design, manufacturing and sales.

Each new design and development has had one prime purpose: to assure—*always*—safe exit in time of emergency.

Von Duprin devices—many of them serving heavy traffic with no major repairs for over 40 years—deliver dependable, day-in, day-out service with minimum maintenance.

Von Duprin offers a nation-wide group of trained consultants whose job it is to review particular installation requirements and recommend the *right* device—without obligation.

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VON DUPRIN DIVISION
INDIANAPOLIS 9, INDIANA

Von Duprin PANIC DEVICES ASSURE SAFE EXIT

UL

Canadian Consultants—Yale & Towne Mfg. Co., St. Catherine's, Ontario

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SAVEALL
SPRINKLER

PRODUCT OF THE CHEMICAL AGE

FOR NEW INSTALLATIONS
FOR REPLACEMENT OF EXISTING SPRINKLERS

UPRIGHT

SOMETHING
NEW
•
SOMETHING
DIFFERENT
•
FIREMEN
EVERY
10 FEET

PENDENT

SAVEALL AUTOMATIC SPRAY SPRINKLERS
APPROVED BY ALL INSURANCE AUTHORITIES

Fifty-five years experience in manufacturing automatic sprinklers enables us to produce the Saveall Automatic Spray Sprinkler, the last word in appearance, sensitivity, durability, efficiency, quality, accuracy of performance.

Illustrated pamphlet available on request.

Manufactured and Installed by
GLOBE AUTOMATIC SPRINKLER COMPANY
Philadelphia, Pa.
Offices in Principal Cities

We engineer, design and manufacture:

Interior Fire Alarm Signaling Systems.

Automatic Heat Actuated Fire Alarm Signaling Systems.

Standpipe Fire Line Control and Signaling Systems.

Central Office Systems for Manual Fire, Automatic Heat Actuated Fire Alarm Systems, Sprinkler Alarm and Supervision, Watch Patrol Recording and Kindred Systems.

Supervisory Systems for Detecting Excessive Heat, Pressure and Low Voltage in Transformer Sub-stations and to Automatically Disconnect the Sub-stations from the Line and Load Sides of the Systems.

Local Sprinkler Alarm and Supervisory Systems.

Smoke and Heat Detecting Systems for Air Conditioning Systems.

Sprinkler Waterflow Detectors.

120 Volt A.C. Vibrating Bells.

Emergency Switches to Shut Down Fuel Oil Systems, Ammonia Compressors and Air Conditioning Systems.

Ground Detector Systems for Hospital Operating Rooms.

ACME FIRE ALARM CO., Inc.

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"Automatic" SPRAY Sprinklers
Save...
LIVES
PROPERTY
MONEY!
For men who know the meaning of safety and business security, language, customs and climate are no barrier. It's ENGINEERED "Automatic" FIRE PROTECTION beyond question.
TO RIO
Thousands of structures throughout the Western Hemisphere are "Automatic" Sprinkler protected. With complete facilities, the whole job, from engineering design to installation and maintenance, can be done faster at a definite cost savings.
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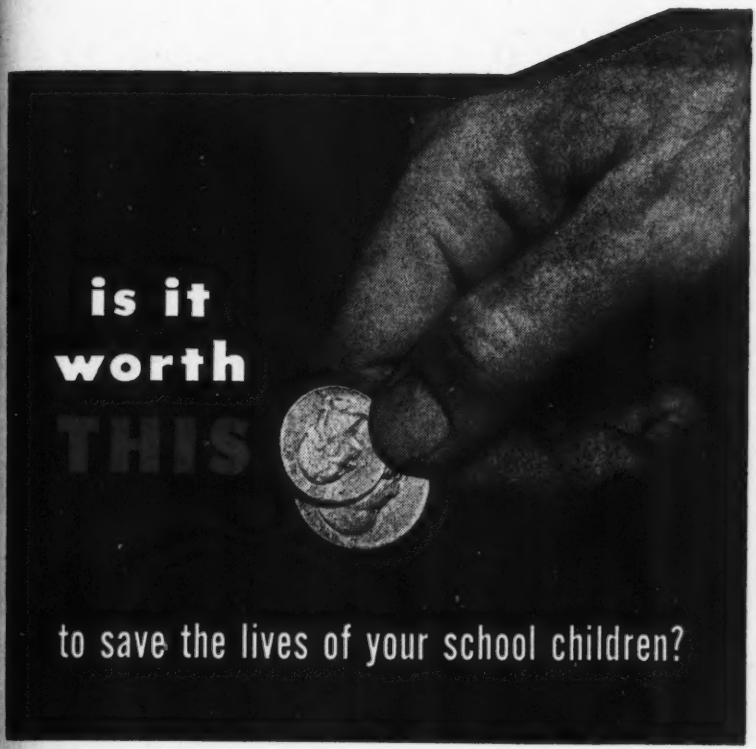
Offices in principal cities of North and South America



Many people don't realize that a community of less than 50,000 people can have safe, sure fire alarm protection for an average annual cost of 75¢ per box per person.

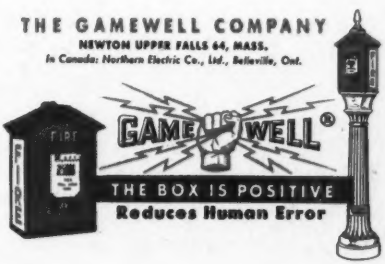
And that cost includes installation of the system, as well as maintenance throughout the years.

Schools — yes, and hospitals, hotels, institutions cannot go unprotected without endangering hundreds of human lives.

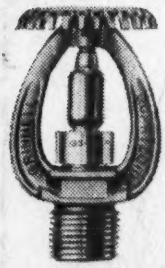
For the full story of safe, sure alarms with a Municipal Fire Alarm System, consult us about making a survey.

There is no substitute for the Municipal Fire Alarm System

THE GAMEWELL COMPANY
NEWTON UPPER FALLS 64, MASS.
In Canada: Northern Electric Co., Ltd., Belleville, Ont.



GRINNELL SPRAY SPRINKLERS



Quartzoid Upright

Quartzoid Pendant

DuraSpeed Pendant

DuraSpeed Upright

Put Out More Fire with Less Water

Grinnell Automatic Spray Sprinklers create a high, wide and even distribution of water — for maximum cooling of fire gases and quicker extinguishment of fire. These Sprinklers provide —

- Better protection — the greater the hazard, the greater the improvement in protection.
- More efficient water distribution . . . less water puts out more fire.
- More uniform coverage — from multiple operation or from a single sprinkler.
- More effective ceiling protection, without wetting the ceiling.
- Lowered ceiling temperatures prevent unnecessary sprinkler openings.
- Interchangeable with conventional sprinklers without piping changes.
- Unexcelled Grinnell Quartzoid Bulb or DuraSpeed release mechanisms.
- Listed by Underwriters' Laboratories, Inc. and approved by Factory Mutual Laboratories.

For descriptive literature write Grinnell Company, Inc., Providence, R. I.
Offices in principal cities of United States and Canada.

GRINNELL

FIRE PROTECTION SYSTEMS

Manufacturing, Engineering, and Installation of Automatic Sprinklers Since 1870